THE JOURNAL

OF THE

BOARD OF ARTS AND MANUFACTURES

FOR

UPPER CANADA.

EDITED BY HENRY YOULE HIND, ESQ., M.A., F.R.G.S.

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VOLUME II.

TORONTO:

PRINTED FOR THE BOARD OF ARTS AND MANUFACTURES FOR UPPER CANADA,
BY W. C. CHEWETT & CO., KING STREET EAST.

1862.

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FOR THE YEAR 1862.

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THE JOURNAL

OF THE

Board of Arts and Manufactures

FOR UPPER CANADA.

JANUARY, 1862.

ON THE CARBURATION OF ILLUMINATING GAS BY PURIFIED PETROLEUM, AND ON THE MANUFACTURE OF GAS FROM THE CRUDE PETROLEUM OF CANADA AND THE U. S.

The importance of petroleum or rock oil, may be gathered from the following extract which we take from a circular by Mr. Alexander Macrae, oil and produce broker, of Liverpool, dated 16th December:—

"The introduction of petroleum, kerosine, photogene, or rock and well oil, is making tremendous strides, though it does not surpass the prediction in my first circular, namely, that it would be second only in extent to cotton. I will even go a step further, and venture to assert that if the rocks and wells of Pennsylvania, Canada, and other districts continue their exudation at the present rate of supply, the value of the trade in this oil may even equal American cotton. Montreal (internally, and likely externally by this time) is lit with the white refined, and I can see no reason why London and Liverpool should not also be, for the oil gas distilled from the raw petroleum is immensely superior and much more brilliant than our own coal gas. For years we have sent coals to America for gas works, and it will be a singular freak of events if she and Canada should now supply us with a better expedient. Invested interests will perhaps stay it for the moment, but will they ultimately?

"The refined for burning (known in this country as paraffin oil, and of which about 500 tuns a week are sold), has been selling at £30 to £40 per tun (of 252 gallons) for yellow to white, while the crude varies in value from £6 to £25, according to test. The merits of the petroleum will be better understood when importers are informed that beside the uses already named, lubricating oils of every colour and specific gravity can be obtained from it; wax also for the manufacture of paraffin candles, naptha, and consequently benzole (from which the fashionable dyes, magenta, rosenine, aniline, &c., are obtained), pitch, &c., &c., all of them having several other applications. It is reported on the very best authority, that they have discovered from it now, an available substitute for spirits of turpentine for paints, and also a solvent for india-rubber, results, I understand, that they have not effected in America or Canada, and the importance of which cannot be over estimated.

"In my first circular it was stated that some 7,000 barrels of crude and refined were on their way to this country, and the *Times* of the 13th instant, mentions 8,000 barrels on the way to London. There are 10,000 barrels coming to Liverpool, and 2,000 barrels to Glasgow, in all about 20,000 barrels (or £100,000 sterling, and the trade not six months old), a simple tithe of what we want! American hostilities and the ice in the St. Lawrence (although we have still St. John's, New Brunswick) may stop supplies to some extent, but I have no doubt the future will vindicate the expectations I have so frequently expressed."

The London *Engineer* of recent date, says, that—

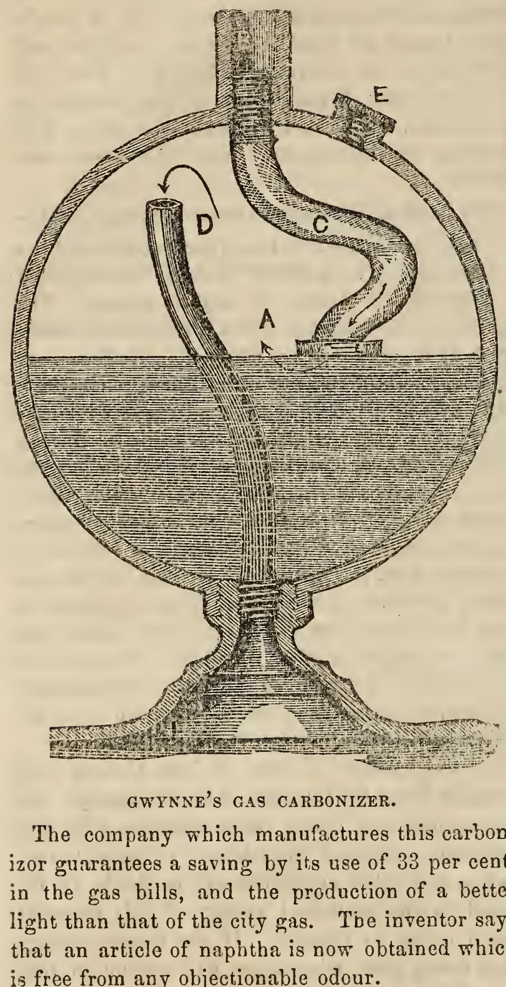
"A prospectus has been issued inviting subscriptions for an increase of the capital of the Asphaltum Company to £200,000, or double its original amount. The business of the company, which is respectably constituted, is to work certain mines of asphaltum near Havana, for the distillation of oil, which commands a ready sale in England at apparently a very remunerative price. The outlay for the property in Havana has been £68,000, of which only £18,000 was in cash, the payment for the remainder being in shares, which are not to rank for dividend until ordinary holders have received 5 per cent. The purchase included a concession from the Spanish Government of the exclusive privilege of making oil from asphaltum in Cuba and Porto Rico for fifteen years, and as the annual consumption of oil in Cuba is estimated at £250,000, this is considered valuable. The directors, engineer, and manager of the company are to be remunerated by a per centage on the profits."

The exportation of rock oil from Canada will probably affect the interests of this Company. As soon as easy and cheap communication with the petroleum springs of Enniskillen is effected the attention of English capitalists will no doubt be directed to the abundant supply of this material which exists in Canada. If the Gaspé springs yield freely great advantages will accrue to that part of the province in consequence of its proximity to the seaboard.

One of the most recent and important applications of Petroleum is the carburation of gas, by its introduction into common coal gas, as ordinarily supplied to consumers. Subjoined is a brief description, from the *American Gas-light Journal*, of 'Gwynne's Gas Carbonizer.'

A hollow globe, A, is introduced into the gas pipe before the burner. This globe is partly filled with naphtha, benzole, or other suitable liquid hydrocarbon, and the illuminating gas is brought into it at the top through the pipe B. The gas passes down through the hollow wick, C, into the liquid, and rising charged with vapour, passes out through the pipe, D, to the burner. The lower end

of the wick, C, is supported by a float resting upon the liquid, and thus follows the surface down as the liquid is consumed. The pipe, D, rises above the level of the filling tube, to prevent all danger of its ever receiving any liquid.



GWYNNE'S GAS CARBONIZER.

The company which manufactures this carbonizor guarantees a saving by its use of 33 per cent. in the gas bills, and the production of a better light than that of the city gas. The inventor says that an article of naphtha is now obtained which is free from any objectionable odour.

The Report of the Engineer to the Commissioners of Sewers of the city of London, on "*The Carburation of Gas*," was referred by that body to Dr. Letheby. The testimony of this distinguished chemist on the mode adopted in England for "carburating gas," is of great value.

"The apparatus consists of a chamber for holding coal naphtha, and of a contrivance for directing the stream of gas over the surface of the naphtha. By this means the gas becomes charged with volatile hydrocarbons, and acquires a higher illuminating power.

"Three sets of experiments were made for the purpose of determining the value of the apparatus. In the first set a naphtha rich in benzole was employed, and the results were, that at first it raised the illuminating power of ordinary twelve-candle gas to twenty-four candles, and in the course of three days the power fell to eighteen candles, the mean of the whole being twenty-one candles. This is an increase of 77 per cent., and it was effected by giving 10·77 grains of naphtha to each cubic foot of gas.

"In both of the other sets of experiments an inferior kind of naphtha was used, and in one case the average increase of illuminating power, during a period of ten days, and after the passage of a thousand cubic feet of gas, was 25 per cent. In the other case, after a duration of five days, the average increase was 30 per cent. The former was effected by the addition of four grains of naphtha vapour to each cubic foot of gas, and the latter by 6·56 grains.

"These data are sufficient to indicate the general capabilities of the apparatus; for they show that with a good naphtha, supplied in proper quantity, and furnishing from ten to eleven grains of vapour to each cubic foot of gas, the illuminating power of an inferior gas may be nearly doubled. A less volatile naphtha, giving only from four to seven grains of vapour per cubic foot, will increase the power of twelve-candle gas from 25 to 30 per cent. I am, therefore, of opinion, that the apparatus is of practical value as a carburetting agent, and that if supplied with good naphtha, in proper quantity, there will be no difficulty in sustaining a power of twenty candles with ordinary coal gas."

Upon receiving this Report and Appendix, the Commissioners of Sewers resolved that it should be referred to the Engineer and Medical Officer of Health, to consider the conditions of the contracts for public lighting; having special reference to the increased illuminating power of the gas to be supplied, and to the possibility of carburating the gas by the process of the Carburating Company.

These gentlemen, Dr. Letheby and Mr. Haywood, have now reported upon this subject in the following terms:—

"Before considering the general conditions of a contract, it is necessary firstly to obtain the determination of your honourable Board to the leading principles upon which the contract should be framed, and it is to those we now specially address ourselves.

"As regards that portion of the reference which relates to the possible reduction of the consumption of gas in the street lamps, we are of opinion that, if the carburating process is not applied, the increase of the illuminating power proposed by the Metropolitan Gas Act of 1861, does not render it expedient to diminish the amount of gas to be supplied at the burners of the public lamps; and that the contract should therefore remain as heretofore in this respect, unless the Companies alter the quality of the present supply, and furnish Cannel gas to the public lamps, as the Act of Parliament empowers them to do: under which circumstances it will be necessary to readjust the contract and mode of supply accordingly.

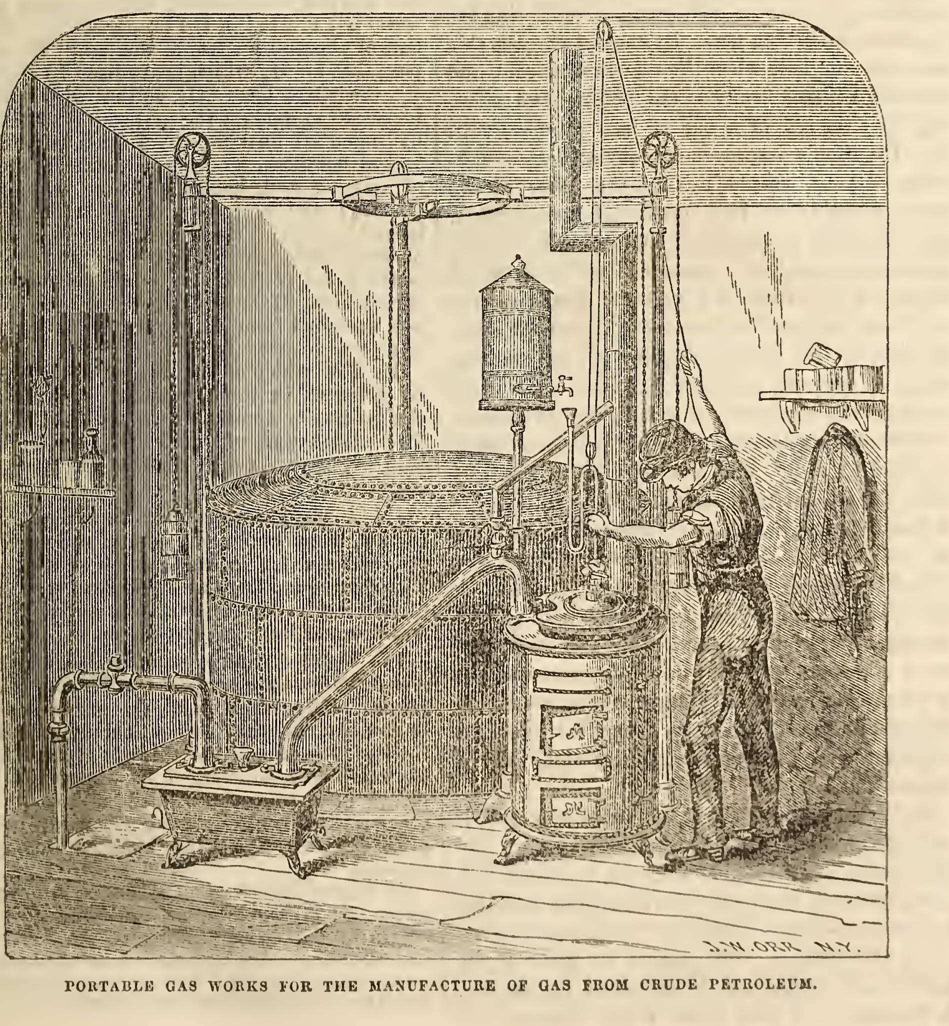
"With regard to the carburating process, we are of opinion, from the data obtained by the laboratory experiments quoted in the report to the Commission of the 30th July last, and the experi-

ments made on the public lamps in Moorgate Street, during the months of June and July last, that the process of carburation appears to be capable of economising the use of gas in the public lamps, to the extent of from 40 to 50 per cent. This conclusion is founded on the assumption that the best quality of naphtha is to be used, namely, a naphtha which will give to the gas continuously a proportion of about ten grains of volatile hydrocarbon to each cubic foot of gas: these being the average results of the laboratory experiments. If an inferior kind of naphtha be employed, the results will be less satisfactory; for the laboratory experiments show that a naphtha yielding four grains of volatile hydrocarbon will increase the illuminating power of the gas to only about from 15 to 20 per cent.

"It is manifest, therefore, that the practical efficacy of these results will be entirely dependent on the perfection of the apparatus and the quality of the naphtha, and we are of opinion that these essential conditions can only be secured during the earlier application of the process by an arrangement with the Carburating Company for the supply of the apparatus and the naphtha, as also for the maintenance of the same in complete working order, according to the terms of a contract founded on the preceding data, namely, that a burner consuming three feet of the naphthalised gas per hour shall give continuously the light of a burner consuming five feet per hour of the same gas not naphthalised; and to secure this, the naphtha should be of such quality as to furnish continuously not less than seven grains of volatile hydrocarbon to each cubic foot of the gas. If the Company is willing to undertake such a contract upon suitable terms, we see no difficulty in the practical application of the system.

"If these suggestions are adopted, it will be necessary to contract both with the Gas Companies and the Carburating Company; the terms under such contracts, which should have due relation to each other, must be a matter for future consideration."

The most recent, and perhaps the most important application of the crude petroleum of this continent to the purposes of practical life is its use for the manufacture of illuminating gas. In various parts of the United States this product has already been applied with success for the above



PORTABLE GAS WORKS FOR THE MANUFACTURE OF GAS FROM CRUDE PETROLEUM.

purpose, and recently in Toronto, Mr. James Thomson announced that he had succeeded in making gas of very superior quality, and at a very low rate, by using the portable rosin oil gas works similar to those figured on the preceding page. No alteration in form is needed, and the petroleum is used quite in the crude state.

These improved portable gas works are manufactured by Mr. Thomson, at his establishment on King Street, Toronto, and are furnished by him complete, with gasometers, which govern the price of the works, of a capacity of one hundred cubic feet to that of one thousand or more. A gasometer of the first-named cubical contents requires one retort; of 600 cubic feet capacity, two retorts, and of 1000 cubic feet capacity, three retorts.

The apparatus is very simple and consists of retort, wash-box or condenser, gas-holder and tank, which are common to all gas-works; but one of the greatest difficulties encountered by inexperienced persons, has been freeing the retorts from an incrustation of carbon which accumulates during the operation of making gas. By the old process, this cleaning was done when the retorts were cold, and the scale adhered firmly to the bottom and sides, requiring the aid of a bar of iron to remove it. Mr. Thomson's improvement obviates this difficulty; for by simply raising the cover of the retort, which is set in a groove of fusible alloy, and admitting a current of atmospheric air, the carbonaceous matter is consumed and passess off through a pipe connected with the flue, carrying with it all the smell and smoke; this is done when the retort is hot, and the cleaning process occupies but a few minutes, leaving the retort in a condition to continue the operation of making gas if required.

The apparatus employed for the manufacture of gas from rosin, oil, &c., has been so successfully used for making it from crude petroleum, without the slightest change in the arrangement for supplying the retorts with the material, and without any difficulties arising from impurities as yet observed, that we have no doubt the application of this abundant material for illuminating and other purposes, is fraught with very important consequences to those parts of the country where petroleum abounds, and to all interests dependent upon the manufacture and use of the products which may be obtained from it.

The illuminating power of petroleum gas is much greater than that of common coal gas, and the expense of production amounts to about one-third, but with regard to this important question we shall have more to say in a future number.

All information with respect to price of the portable gas works, will be furnished by Mr. Jas. E. Thomson, 109 King Street West, Toronto.

NOTE ON THE FORMATION OF PETROLEUM AND ALLIED SUBSTANCES FROM WOODY FIBRE OR ANIMAL TISSUE.*

We have stated in the preceding paper that the different mineral combustibles have been derived from the transformations of vegetable matters, or in some cases of animal tissues analagous to these in composition. The composition of woody fibre or cellulose, in its purest state, may be represented by $C_{24}H_{20}O_{20}$, or as a compound of the elements of water with carbon: the incrusting matter of vegetable cells, to which the name of lignine has been given, contains however a less proportion of oxygen and more carbon and hydrogen than cellulose, so that the mean composition of recent woods, as deduced from numerous analyses of various kinds, may be represented by $C_{24}H_{18\cdot4}O_{16\cdot4}$. We may conceive of four different modes of transformation of woody fibre, all of which probably intervene to a greater or less degree in the production of mineral combustibles; and in considering these changes we shall for greater simplicity adopt for the composition of woody fibre the first named formula, $C_{24}H_{20}O_{20}$.

I. When wood is exposed to the action of moist air, oxygen is absorbed, and carbonic acid and water are evolved in the proportion of one equivalent of the first for two of the last. We may suppose that for H_2 which is oxydised by O_2 from the air, the wood loses CO_2, so that while the carbon increases in amount the proportions of oxygen and hydrogen are unchanged. In this way an equivalent of cellulose, by absorbing sixteen equivalents of oxygen and losing eight of carbonic acid, ($8\ CO_2$) and sixteen of water, ($16\ HO$) would leave $C_{16}H_4O_4$. Such is the nature of the decay of wood when exposed to the air, and the process, could it be carried out, would leave a residue of carbon only. If however the wood is deeply buried and excluded from the oxygen of the air two reactions are conceivable.

II. The whole of the oxygen of the wood may be given off in the form of carbonic acid, while the hydrogen remains with the residual carbon. The abstraction of ten equivalents of carbonic acid from one of woody fibre, would leave a hydrocarbon, $C_{14}H_{20}$.

III. Instead of combining exclusively with the carbon, a part of the oxygen of the wood may be set free as water, in combination of the hydrogen. The abstraction from an equivalent of woody fibre of four equivalents of carbonic acid and twelve of water would leave a hydrocarbon $C_{20}H_8$.

IV. These decompositions are however never so simple as we have supposed in II. and III., for a portion of hydrogen is at the same time evolved in combination with carbon, chiefly as marsh gas, C_2H_4. The amount of this gas evolved from decaying plants submerged in water, and the immense quantities of it condensed in coal beds and other rocky strata, (forming fire damp) shew the great extent to which this mode of decomposition prevails.

In nature these various modes of decomposition often go on together, or intervene at different stages in the decomposition of the same mass;

* By Dr. Sterry Hunt, in a paper communicated by that gentleman to the "Canadian Naturalist and Geologist."

they are besides seldom so complete as we have represented them. The first process results in the formation of vegetable mould, which always retains portions of carbon and hydrogen; while the incomplete operation of the processes II., III. and 14. gives rise to peat, lignite, brown coal, bituminous coal, and pyroschists, in all of which the proportion of the oxygen is much less than the hydrogen, so that their composition may be approximately represented by mixtures of hydrocarbons with vegetable fibre. The following results have been selected from a great number of analyses by various chemists, and are for the most part taken from Bischof's *Chemical Geology*, (Vol. i. cap 15.) The nitrogen, which in most cases was included with the oxygen in the analysis, has been disregarded, and the oxygen and hydrogen, for the sake of comparison, have been calculated for twenty-four equivalents of carbon:—

1. Vegetable fibre or cellulose......$C_{24}H_{20}O_{20}$
2. Wood, mean composition........$C_{24}H_{18\cdot4}O_{16\cdot4}$
3. Peat (Vaux) ....$C_{24}H_{14\cdot4}O_{10}$
4. Do. (Regnault) ....$C_{24}H_{14\cdot4}O_{9\cdot6}$
5. Brown coal (Schrötter)..........$C_{24}H_{14\cdot3}O_{10\cdot5}$
6. do. do. (Woskresensky)...$C_{24}H_{13}O_{7\cdot6}$
7. Lignite (Vaux).......................$C_{24}H_{11\cdot3}O_{6\cdot4}$
8. do. passing into mineral resin (Regnault)........................$C_{24}H_{15}O_{3\cdot3}$
9. Bituminous coal (Regnault)....$C_{24}H_{11}O_{3\cdot3}$
10. do. do. do. ....$C_{24}H_{10}O_{1\cdot7}$
11. do. do. do. ....$C_{24}H_{8\cdot4}O_{1\cdot2}$
12. do. do. do. ....$C_{24}H_{8}O_{0\cdot9}$
13. do. do. (Kühnert and Gräger)........................... $C_{24}H_{7\cdot4}O_{1\cdot3}$
14. do. do., mean composition (Johnston)....................$C_{24}H_{9}O_{2}$—O_{4}
15. Albert coal (Wetherell)..........$C_{24}H_{15\cdot9}O_{1\cdot6}$
16. Asphalt Auvergne.................$C_{24}H_{17\cdot7}O_{2\cdot2}$
17. do. Naples.................. ...$C_{24}H_{14\cdot6}O_{2}$
18. do. Bastennes ....$C_{24}H_{16}O_{0\cdot7}$
19. Elastic bitumen, Derbyshire, (Johnston)..........................$C_{24}H_{22}O_{0\cdot3}$
20. Bitumen of Idria..................$C_{24}H_{8}$
21. Petroleum and naphtha..........$C_{24}H_{24}$

In the above table we see the transition from peat and brown coal to lignite, and thence to bituminous coal. Professor Johnston, from his experiments in various coals, including cannel from Wigan, splint coal from Workington, and caking coal from Newcastle, deduced the composition given in 14, in which with $C_{24}H_{9}$ the oxygen varies from two to four equivalents. It will be seen from a comparison of the infusible Albert coal with the bitumens 16, 17 and 18, how gradual is the transitions to the true petroleums and naphthas, from which oxygen is absent. The asphalts also, as will be observed, differ very much in their composition, and though generally much richer in hydrogen than the bituminous coals, the variety from Naples, (17) which is completely fusible at 140° C., contains less hydrogen and more oxygen than the Albert coal analysed by Wetherell; while the idrialine or bitumen found with the mercury ores of Idria, approaches very nearly in composition to the bituminous coals 11, 12 and 13, with which many asphalts may be said to be isomeric. It is however probable that those oxygenized bitumens, unlike the coals, are products of the oxydation of naphtha or petroleum, by a process similar to that by which resins are derived from vegetable hydrocarbons. These formulas must be taken as representing not the true equivalents, bnt only the proportions of the elements in the bodies in question, which are in most cases mixtures of various substance. This is especially true of naphtha, which may be taken as the representative of pure unoxydised petroleum, and which is separated by distillation into oils of very different boiling points. The late analyses by Uelsmann of the rectified rock oil from Sehnde, near Hanover, gave the formula $C_{18}H_{20}$, and according to De la Rue and Müller the greater part of the Rangoon petroleum consists of hydrocarbons in which the number of equivalents of hydrogen is a little greater than the carbon; one gave $C_{26}H_{28}$. Associated with these are however portions of bodies containing a less proportion of hydrogen, so that we may conceive the mean composition of petroleum to be represented, as in the preceding table, by equal equivalents of hydrogen and carbon; many forms of solid bitumen also, as ozokerite and hatchetine, have the same general composition.

By referring to what has been said above it will be seen that the final result of the third process of decomposition of woody fibre, in which the air being excluded, the oxygen is shared between the carbon and hydrogen, would be $C_{20}H_{8}$. A similar result would be obtained, with the simultaneous evolution of marsh gas, if we suppose $6\ CO_2+8\ HO+3\ CH_2$ to be removed from an equivalent of woody fibre, leaving $C_{15}H_{6} = C_{20}H_{8} = C_{24}H_{9\cdot5}$, which approaches the composition of most bituminous coals and of idrialine. A farther elimination of marsh gas would leave a residue of pure carbon, and thus, as Bischof has suggested, vegetable matters may be converted into anthracite without the intervention of a high temperature.

The elimination of the whole of the oxygen in the form of carbonic acid would leave a compound with a large excess of hydrogen, of which it would be necessary to remove a portion in the form of water or marsh gas in order to reduce the residue to the composition of petroleum. We know of no combination of carbon and hydrogen in which the number of atoms of hydrogen surpasses by more than two, those of hydrogen, the general formula being C_nH_{n+2}, so that oils like $C_{18}H_{20}$ and $C_{26}H_{28}$ contain nearly the maximum quantity of hydrogen, and a body like $C_{14}H_{20}$, whose formation we have supposed above, could not exist, but must break up into marsh gas and some less hydrogenous oil like petroleum.

We do not know the precise conditions which in certain strata favour the production of petroleum rather than of lignite or coal, but in the fermentation of sugar, to which we may compare the transformations of woody fibre, we find that under different conditions it may yield either alcohol and carbonic acid, or butyric and carbonic acids with hydrogen, and even in certain modified fermentations the acetic, lactic and propionic acids, and the higher alcohols, like $C_{10}H_{12}O_{2}$. These analogies furnish suggestions which may lead to a satisfactory explanation of the peculiar transformation by which, in certain sedimentary strata, organic matters have been converted into bitumen.

MARTIN'S IMPROVED SUPERHEATER FOR LOCOMOTIVES.

In the Journal of the Board for the year 1861, we noticed the important invention of Mr. Martin, the Locomotive Superintendent of the Western Division of the Grand Trunk Railway of Canada, for economizing fuel in Locomotives. We have now the opportunity of illustrating this invention from stereotyped plates, which first appeared, we believe, in the *Scientific American*, with the subjoined descriptive notice from the same excellent Mechanical Journal.

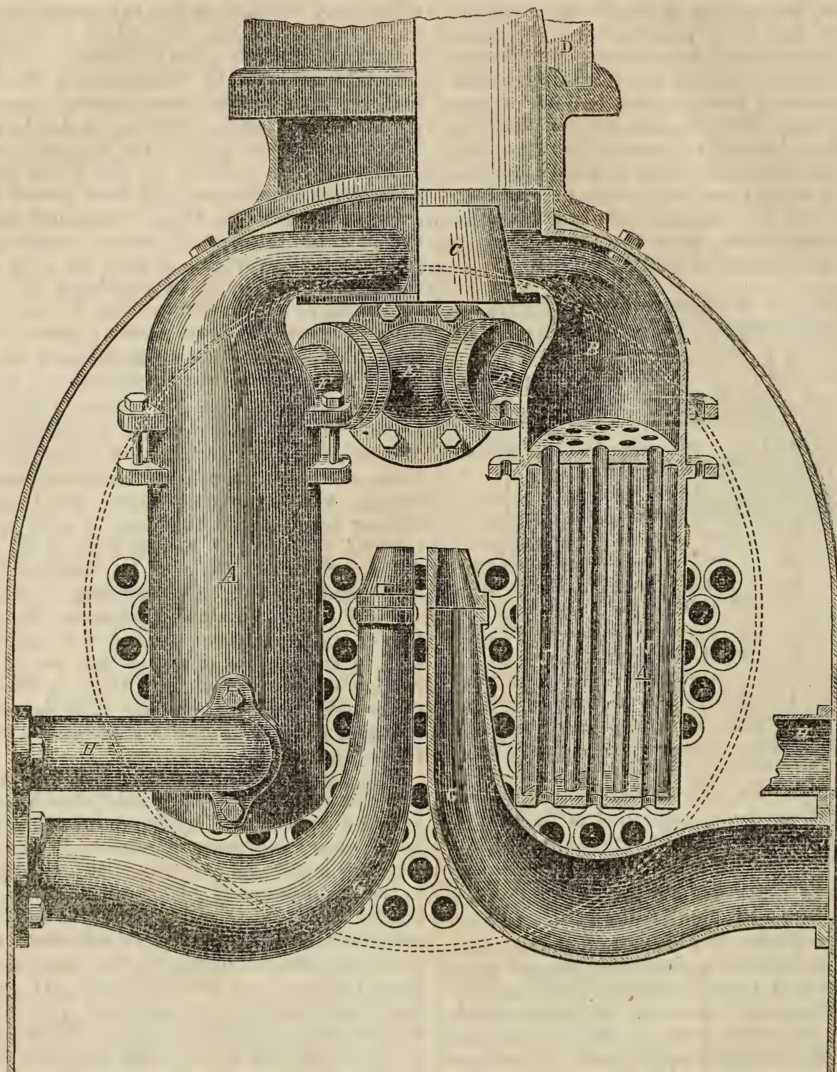


Fig. 1

In boiling water that portion is converted into steam which is nearest to the fire, and as the little globes of steam rise up from the bottom of the boiler through the water, they drive up a portion of water, filling the steam space with spray. As this water is carried into the cylinder it of course does no work there, and thus all the fuel expended in heating it is wasted. To complete the evaporation of this spray, the plan has been adopted of imparting to the steam an additional quantity of heat after it has left the water. This is called superheating; it has attracted a great deal of attention, and many forms of mechanism have been devised to accomplish it. The plan which we here illustrate is designed for locomotive engines only. It is now in use on several locomotives on the

Grand Trunk Railway of Canada, where it is said to have the most satisfactory success.

In the accompanying engravings Fig. 1 is a transverse section of a locomotive smoke box, in which is placed the improved exhaust chamber and steam surcharger, shown partly in elevation. Fig. 2 is a longitudinal section of the same.

Like letters refer to like parts in each of the figures.

A A are tubular chambers arranged within the smoke box, having a number of flues, J, opening at the bottom into the smoke box, and opening at the top into the large flues or pipes, B B. These pipes, B B are connected to the tubular chambers,

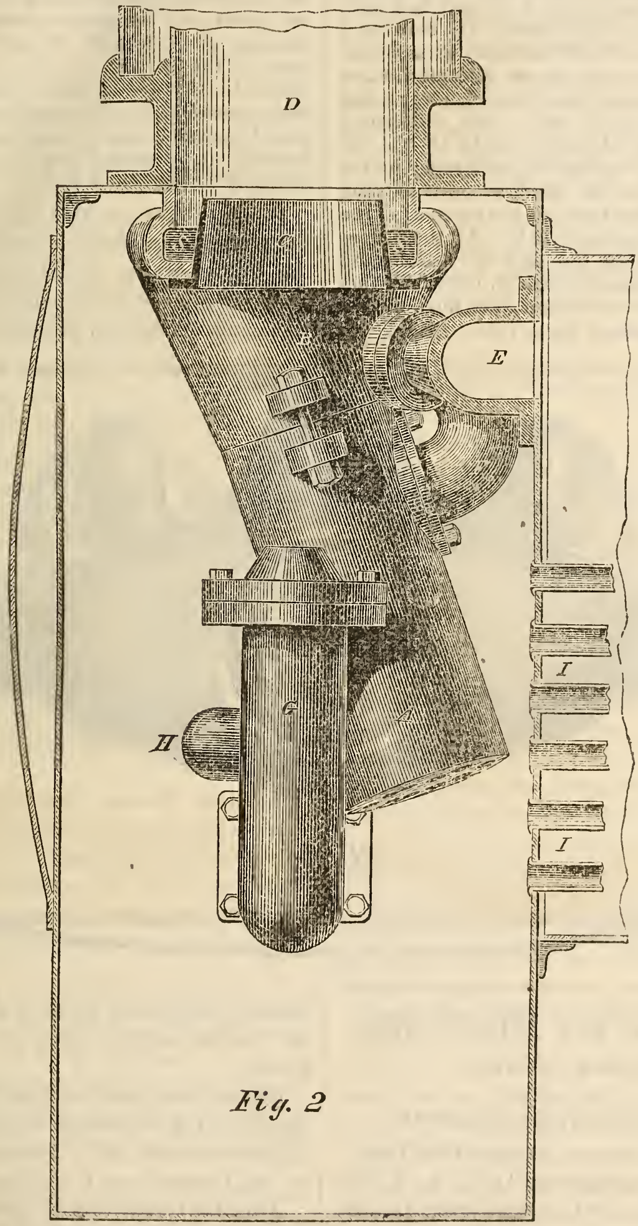


Fig. 2

as shown at S. Their upper ends are bent inwardly toward each other, and flattened and elongated and connected to, and passing nearly around the short cylinder, C, placed within the smoke pipe, and forming by their junction therewith an annular chamber, S, which opens into the smoke pipe, D, and causes a strong draught through the flues, J, and through the lower flues of the boiler.

F F are steam pipes branching from the main steam pipe leading from the boiler, and conveying steam from the boiler into the tubular chambers, A, in which the steam will fill the spaces between the flues, and become superheated by the flues.

From the chambers, A A, it is conveyed to the steam cylinders of the engine by the pipes, H. G are the exhaust pipes opening into the smoke box

in the usual way. H H represent the pipes leading from the superheating apparatus to the steam chest.

The operation of this improvement may be described as follows:—The exhaust steam, as it is discharged from the exhaust pipes, G, will cause a strong draught through the chimney. But this draught, though it will strongly exhaust those flues of the boiler which open into the smoke box near the top and centre, or at the level of the mouths of the exhaust pipes, will only partially exhaust the lower and side flues, and hence, without further improvement, the lower flues become more or less choked up, as is well known. But the strong draught through the chimney, made by the exhaust, will cause a vacuum to be formed in the annular chamber, S, to fill which vacuum a strong draught will be formed through the flues, J, of the chambers, A, and the pipes, B B. As these flues open into the the smoke box near the bottom and sides thereof, the draught through them will thoroughly exhaust the lower and side flues of the boiler, and thereby keep them free from all obstructions and allow the flame a free passage. The smoke and hot gases which pass up these flues, J, will superheat the steam as it circulates in the space around them in the chambers, A, on its way to the steam cylinders, so that, when it passes from the chambers, it will be perfectly dry and free from moisture. It will thus be seen that, by the use of this improvement, is accomplished several great and important advantages: 1st, The increase of the draught through the lower and side flues of the boiler; 2d, The superheating of the steam by the use of waste smoke and hot gases which accumulate in the smoke box or which pass out of the smoke pipe; 3rd, And as a consequence thereof, an increased power of steam and great economy in the use of fuel.

It is needless to say that this admirable invention has created considerable interest in England and the United States, and it promises to become of great importance in economizing fuel, a very serious item of Railway expenditure.

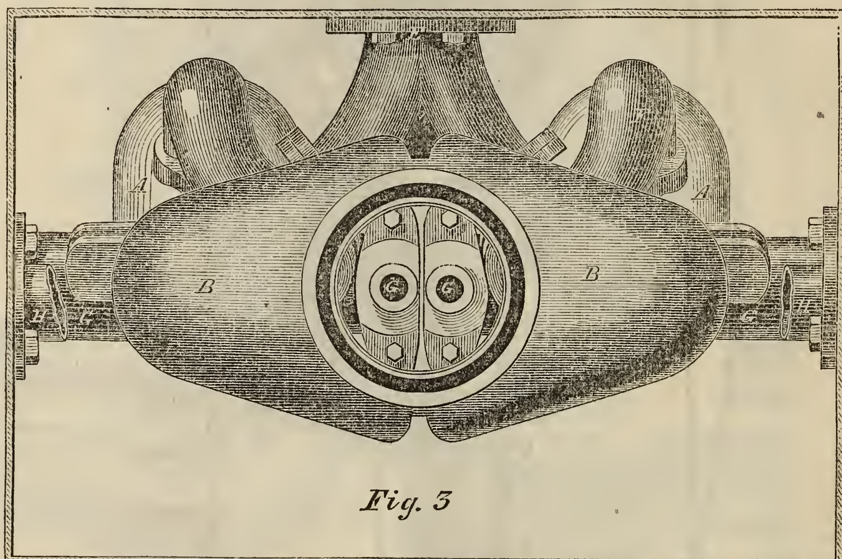


Fig. 3

Board of Arts and Manufactures
FOR UPPER CANADA.

MEETING OF THE SUB-COMMITTEE.

TORONTO, January 14th, 1862.

The Sub-Committee met at $11\frac{1}{2}$ A. M., in the Board Room, Mechanics' Institute; Prof. Hincks, in the absence of the President, in the chair.

After reading of minutes, letters were read from the Secretary of the Board for Lower Canada, in respect to the Journal for 1862; and from Mr. E. A. McNaughton, the appointed agent for the Board east of Toronto, stating that after a short absence on his canvassing tour, he had been called home by illness and death in his family, but that he intended starting again on Monday the 13th instant.

Reports were received from Mr. George E. Pell, Agent for the Board west of Toronto, in reference to manufactures, and to his canvass for specimens for the International Exhibition.

After the transaction of some routine business, the Secretary read a draft of a Report to be submitted to the Annual Meeting of the Board, which was unanimously adopted.

The Secretary stated that in addition to the pianos reported by Mr. Pell, for the International Exhibition, he had received a notification from Messrs. Thomas & Co., of Toronto, of their inten-

tion to prepare a grand piano, on a new and patented principle of construction, for the same purpose.

The meeting then adjourned.

W. EDWARDS, *Secretary*.

Report of George E. Pell, Agent of the Board of Arts and Manufactures for Upper Canada.

January 7th, 1861.

HAMILTON.

Messrs. Bridge, Higby & Co., employ one hundred men and fifty women in the manufacture of felt hats; the wages of the men will average $1.50, the women 75 cents per diem.

They consume wool of the value of twenty-seven thousand dollars per annum; it is imported, Canadian wool not being of sufficient fineness. Skivers, or the leather trimming used inside the hats, they have induced a tanner to manufacture for them; heretofore they were imported. Annual value of skivers, two thousand seven hundred dollars.

Twenty-five of their men emigrated to Canada to enter their employment.

Five hundred persons at least, depend upon the employees in the factory.

The annual value of their manufactures will be seventy-five thousand dollars.

Messrs. Sanford & McInnes, employ from four to five hundred men and women in the manufacture of ready-made clothing. From twenty to twenty-five were induced to come to Canada to enter their employment.

Canadian cloths enter largely into their manufactures.

The business having only recently been established, no estimate was given of the extent or value of their manufactures, excepting what might be gathered from the number of hands employed, together with the fact that sewing machines are used by the employees, they working in gangs and by the piece.

Messrs. Nisbet & Co., boot and shoe manufacturers, employ one hundred men and women, average wages of men, one dollar per diem.

Annual value of sales, fifty thousand dollars (of their own work,) they sell imported goods besides.

They use all the material they can of Canadian manufacture.

P. W. Dayfoot, boot and shoe manufacturer. Particulars same as of Nisbet & Co., in reference to shoe business, but P. W. D. carries on the tanning (in addition) at Georgetown. Imports hides, the supply not being sufficient for the demand in Canada.

Hopkins & Ackland, boot and shoe manufacturers. Same as others. (A. Gordon, one half.)

Wanzer & Co., sewing machine manufacturers, the Wheeler & Wilson & Singer Machines. Employ sixty hands, at an average wage of one dollar and fifty cents per diem. From twenty to thirty were induced to emigrate to Canada to enter their employment. Import nothing that they can procure in Canada. The annual value of their manufactures is about sixty thousand dollars.

In this city there are also three other factories making sewing machines of the Singer, Dale's Excentric and Rogers' Patent. They employ from five to ten hands each. It was not agreeable for them to give further particulars.

F. G. Beckett & Co., steam engine and boiler manufacturers, employ on the average twenty-five men. Average wages one dollar and fifty cents. Manufactures principally agricultural portable engines. (At this establishment they were working night and day to get worms, stills, &c., made for two coal oil refineries.)

Yearly value of their manufactures twenty-five thousand dollars.

Northy & Sons, saw-mill and stationary engine manufacturers. Ten men in good years. Erect few engines to order. Now confined principally to repairs.

At this establishment I was shown a condensing engine, invented by Mr. Thomas Northy, of about five horse power, which consumed no more fuel than a box stove of medium size would. Mr. N. is getting it patented in Canada and the United States, expecting to reap a large amount of money by selling rights to manufacturers.

I also had explained to me "a man guard," that this same person has invented, to protect the persons of sawyers from the terrible consequences of a fall upon the large circular saws now so commonly in use in the lumber districts.

Messrs. L. & P. Sawyer, manufacturers of threshing and mowing and reaping machines, fanning mills, ploughs and stoves. Employ on the average twenty-four men.

Manufacture twenty thousand dollars worth per annum.

Turnbull & Co., stoves, ploughs, &c., &c., employ twenty men. Average wages one dollar and thirty cents. Consume about one hundred and fifty tons of pig iron in the year.

D Moor & Co., tin and japanned ware, stamped and pressed tin ware; also, stoves and castings. Employ forty-five men at an average wage of one dollar and twenty-five cents per diem.

Import about fifty thousand dollars worth. Manufacture about twenty-five thousand dollars worth. (This Firm collects about twelve to fifteen thousand dollars worth of rags in the course of the year).

N. B. Robbins, coal grates and iron railings. Annual value of manufactures about five thousand dollars.

Imports fire bricks. Does not think the clay exists in Canada suitable for their manufacture.

B. C. Charlton, vinegar manufacturer, employs four men. Average wages one dollar and six cents per diem. Consumes in a year twelve thousand gallons proof spirits, two thousand pounds refined sugar, four hundred bushels barley malt, and some cider. Has not imported any article he uses since alteration in tariff.

C. L. Thomas, pianoforte manufacturer, employs sixteen men at an average wage of one dollar and fifty cents per diem. Eight men left the United States to enter his employment, they with their families numbering thirty persons. Sixty persons derive their support from this manufactory.

Manufactures pianos during the year, to the value of twelve thousand dollars. Experiences no difficulty in selling all he makes. Averages two per week.

(Mr. Thomas was formerly an importer, and then sold as many pianos as now, but owing to the tariff, commenced their manufacture, which is now advantageous to him).

E. & C. Gurney, founders and stove manufacturers, employ sixty-four men. Average wage one dollar and sixty cents. Consumes one thousand tons of pig iron and three hundred tons of coal in a year.

Value of manufactures for the year, about one hundred thousand dollars.

Gurney, Ware & Co., platform and counter scales, employ twelve men. Average amount of wage one dollar and forty cents. Seven men emigrated to Canada to enter their employ.

Annual value of manufactures, about twenty-five thousand dollars.

Bruce & Mugrige—brooms—employ twenty men. Average daily wage, one dollar and seventy-five cents. Consumes one hundred tons of broom corn per annum—value, one hundred dollars per ton.

Annual value of their manufactures, forty thousand dollars.

Import all their material.

In Hamilton I found that many of the manufacturers were indifferent to the object of my visit, and excused themselves from replying to my enquiries on account of reasons best known to themselves, especially was this the case in the smaller concerns. Among the establishments from which I obtained no particulars, is the nail, spike and rivet works of Messrs. R. Juson & Co. They employ about ten or twelve men, and manufacture all kinds of cut nails, railroad spikes and rivets. Young Brothers, coal oil lamps manufacturers; Meakins & Sons, and Green, brushmakers; Stewart & Co., iron founders and stove manufacturers; Main & Co., rope and twine manufacturers.

I have ascertained from Mr. E. Roper, wood engraver, that he had made some experiments with Canadian woods, in order to substitute the same for box, to engrave upon. In his experiments he found *white thorn* answer best, and in fact, so satisfactorily, that he is endeavoring to secure a good supply for his own use. I urged him to get samples engraved, and prepared for the engraver, to send to the International Exhibition. If he can get good specimens seasoned and ready he will contribute them. Messrs. Wanzer & Co. will probably send a sewing machine to London. C. L. Thomas will send a first-class pianoforte, if the arrangement with the Commissioners are satisfactory. The superintendents of the locomotive and car departments have promised to enclose me particulars concerning the works of the Great Western Railroad. I have not received them yet. A rumor was prevalent in Hamilton to the effect that an establishment that has lain unused for some years was about to be converted into a cotton factory. Further particulars I could not gather.

To the Committee of the Board of Arts and Manufactures for Upper Canada.

Gentlemen,—The Secretary of the Board having requested me to give the particulars of my success in securing articles for the International Exhibition, I therefore in complying with his request, would state that in Hamilton I met the Board of Directors of the Mechanics' Institute, and they formed a Committee of influential gentlemen in the City, to carry out the objects of the Commissioners in inviting the coöperation of Local Committees.

I canvassed the manufacturers, and endeavored to induce many to prepare articles. In the following instances I received favorable answers, viz.: Mr. C. L. Thomas would have a very superior piano ready by the time the Commissions would be in Hamilton, and if the arrangements of the Commissions in forwarding the articles, were satisfactory, he would send it.

Wanzer & Co. would have a sewing machine ready, Wheeler & Wilson improved, it having the shuttle attached to it.

Other manufacturers would have prepared articles, but the time was not sufficient. In Dundas a Committee was also formed; and in my canvass for articles I obtained the promise of a cracker and biscuit machine from Mr. Gibson, edge tools from Mr. Hourigan, and some lasts, boot trees, &c.,

from Mr. Young. I visited the two woollen mills at Ancaster, but was unable to obtain the promise of anything, they being very busy; in the case of Mr. Crane, who manufactures knitted goods, I think this is much to be regretted as he produces very superior fabrics, specimens of which were shown in London in September last. At Brantford I could hear of nothing. I drove to Port Dover and obtained the promise of some woollen cloths from the new factory just now in operation; they will be forwarded to Isaac Buchanan, Esq., of Hamilton, in time for the Commissioners. If what I have learned is correct, the person who is carrying on this factory is one of the most experienced and able factors that has been engaged in the manufacture of woollen goods in the Eastern States; (Mr. J. N. Pitts), something very excellent may be expected, as it is an establishment of very superior character, the machinery being the best made in New England, and of very recent improvements, and the intention being to manufacture high priced and fine cloths.

At Paris I could learn of nothing. (I spent but a few hours in this place, having to lay over for the train).

In London I was unable to personally meet the Board of the Institute, but I communicated with some of the manufacturers, and then giving a list of the promises I had received from persons who could and would contribute to the Exhibition, I urged the Board by note, to form a Committee, and to still further canvass the City for more articles. I obtained in this City a promise from Mr. M. Anderson to prepare some agricultural implements; from Mr. Brown, the promise of an improved Singer sewing machine, and from Mr. Saunders, a collection of Canadian herbs, (which were exhibited at the last Provincial Exhibition, with the exception of additions since made), extracts and perfumery, if it is possible for him to prepare them in time.

I endeavored to obtain specimens of Canadian woods, but to no purpose; I however, learned of a collection that is in the possession of the Hamilton Scientific Society. I suggested to one of their leading members that they should be sent to England. The collection I believe to be a good and pretty extensive one, although the specimens are not as large as might be desired. Whether my suggestion would be acted upon I know not. I found generally a want of interest in the Exhibition, and every where the excuse was made, there is not sufficient time, and little encouragement. In stating the amount of time I devoted to the work of the Commission, I may say at least half of the nineteen days was spent in serving them. Th ee days wholly was spent in visiting Ancaster and Port Dover; I thought it proper to do so, as in both places fine qualities of goods are manufactured. I think it unfortunate that Mr. Crain, of the first named place, could not be induced to send specimens of his hosiery and knitted goods, as they are very superior, and such as would favorably compare with the products of other countries.

I am, Gentlemen,
Yours, with respect,
George E. Pell.

January 9th, 1862.

PROCEEDINGS OF THE BOARD.

Toronto, January 14th, 1861.

The Board met this day, according to adjournment, at two o'clock, P. M.

The members present were:—Professor Hincks University College, Professor Hind Trinity College University, Toronto; W. Craigie, M.D., James Cummings, Thos. Hilton, Samuel Sharp and Richard Bull, delegates from the Hamilton Mechanics' Institute; Rice Lewis, President, and Patrick Freeland, William Edwards, W. H. Sheppard, John McBean and H. E. Clarke, delegates, Toronto Mechanics' Institute.

In the absence of the President, and the Vice-President, Professor Hincks was appointed to the Chair.

The Minutes of the last Annual Meeting were read and confirmed.

The Secretary read Telegrams from the President, Dr. Beatty; and from Mr. Sheldrick, stating that owing to detention of trains they would not be able to attend the Meeting.

The Report of the Sub-Committee for the past year was then read by the Secretary, when it was

Moved by Mr. Freeland

Seconded by Mr. Lewis, and *Resolved*—That the Report of the Sub-committee now read, be adopted.

The Election of Office bearers and Sub-Committee for the ensuing year then took place, when the following Gentlemen were elected:—

President—John Beatty, Jun., M.D.

Vice-President—Wm. Craigie, M.D.

Secretary and Treasurer—Wm. Edwards.

Sub-Committee—Professor Hincks, Professor Hind, Patrick Freeland, W. H. Sheppard, Professor Buckland, Rice Lewis, Alfred Brunel, Richard Bull and Thos. Sheldrick.

Moved by Mr. Bull, seconded by Mr. Hilton, and Resolved—That the thanks of the Board be given to the Office-bearers and Committee of the past year, for the close attention given to their duties during their term of Office.

Moved by Mr. Hilton, seconded by Mr. Clarke, and Resolved—That the Committee be instructed to Memorialize the Government and Legislature to renew the Annual Grants formerly made to the Mechanics' Institutes of Upper Canada.

The Meeting then adjourned.

REPORT.

The Sub-Committee of the Board of Arts and Manufactures for Upper Canada, beg to submit to the Board the following Report of their proceedings for the past year:

Owing to the very limited sum placed at the disposal of your Committee, they have not been able to render the operations of the Board so useful to the public, or so advantageous to the several Institutes connected with it, as they otherwise might have done. They have, however, the satisfaction of reporting that in some departments of the Board's operations, considerable improvements have been made during their year of office.

Nine Mechanics' Institutes have been represented at the Board during the year, either by their respective Presidents, or by accredited Delegates, elected according to the statute, namely: Ayr, Cobourg, Dundas, Hamilton, Newcastle, Paris, Toronto, Whitby and Woodstock.

The withdrawal from the Mechanics' Institutes of all Government aid, has resulted in the total failure of some, and the paralyzing of the efforts of many others of these institutions, and will no doubt in a great measure account for the absence of a more general co-operation on their part with the objects of this Board. Your Committee look upon these institutions as Schools, or Colleges, for the adult mechanical and industrial classes of the community, affording them means of instruction, and of healthful recreation, so essential to their well-being, and such as is not to be obtained by them through any other agencies now in existence; and are therefore justly entitled to legislative aid corresponding to that given to societies for the encouragement of agriculture, and for purposes of general education.

Your Committee are gratified to know that some few of these institutions in the smaller towns, as well as those of the larger towns and cities, are not only self-supporting, but prosperous and progressive in their operation.

FINANCES.

The Treasurer's detailed Statement, herewith submitted, shows total Receipts for the year $4,685 43; Expenditure, $3,048 80; leaving a balance in hand of $1,636 63. Besides this balance, there are assets due on account of the *Journal* of $287 00, which leaves the whole amount in favor of the Board $1,923 63.

FREE LIBRARY OF REFERENCE.

During the year nearly 200 volumes of valuable books have been added to the Library, which now comprises 449 folio and octavo volumes of Plates and Specifications of English, American and Canadian Patents; 100 volumes of Statutes and other Parliamentary publications of Canada; and 268 volumes of the latest Cyclopedias and works on the Fine and Decorative Arts, Manufactures, &c.; making in all about 817 volumes—a classified Catalogue of which has been published in the September number of the *Journal* of the Board for 1861, with the monthly addition in each subsequent number.

Your Committee have already acknowledged in the pages of the *Journal*, a donation from the Hon. the Commissioner of Patents for the United States, of 30 volumes of Reports, embracing drawings and abridged specifications of patents issued in the United States from the year 1850 to 1860, inclusive.

Since the Board took possession of its excellent suite of rooms in the new Hall of the Toronto Mechanics' Institute, in July last, the Library has been consulted by a large number of persons; and it will no doubt become more and more appreciated as it becomes better known, containing as it does so large a number of works—including some of the best British and American periodicals—of the highest practical value to the professional man, the decorator and the mechanic; and being entirely free for consultation, and more readily accessible than any other free library of a similar character in the Province.

MODEL ROOMS.

In consequence of a recent order of the Patent Office, all new models have to be forwarded to Quebec with the applications for patents, so that but few additions have been made in this department since the last annual Report. Your committee would however acknowledge a donation from Messrs. Maw & Co., England, of four large and beautiful frames of examples of their manufacture of tesselated pavements, and three frames of patterns; also some specimens of building and flagging stone by Mr. Pearson, from his quarries in Esquesing.

With a view to establishing a Museum of specimens of Foreign and Canadian Manufactures, your Committee have invited manufacturers to furnish specimens of their various productions, or of any natural products capable of being used in manufactures, for exhibition in the Rooms.

EXAMINATIONS.

In August last, your Committee issued programmes of Examinations of members of the Mechanics' Institutes, similar to the programme of the year previous; and also offered the sum of ten

dollars to "each Institute establishing and keeping in operation for three months a class of not less than six members, for the study of any of the subjects named in the programme, and submitting at least two members of such class as candidates at the final examination by the Board in May next;" and also offering in addition to the certificates, "silver medals to the most successful candidates, in the proportion of one to every five who shall pass such examinations." Your Committee trusts that Institutes intending to submit candidates for examination in May next will at once notify the Board of such their intention.

JOURNAL.

Your Committee have much pleasure in being able to report, that the first volume of the *Journal* of the Board has been completed, and that it has in all respects fulfilled their expectations, with the exception of correspondence from those engaged in the manufactures of the Province, and correspondence and support from the larger number of the Mechanics' Institutes, whose interests it is one of the principal objects of the *Journal* to advocate.

Arrangements have been made for publishing the second volume in an enlarged and improved form, each number to contain four pages more of Reading Matter, be supplied with a cover, and stitched and cut; these improvements your Committee believe will be very acceptable to its readers, and be the means of inducing a large increase to the Subscription list.

It is also intended to publish the Journal on the 15th of each Month, instead of the 1st, as being more convenient for the Publishers.

Your committee would respectfully invite the coöperation of such Institutes as have not yet taken any steps towards sustaining the Journal, either by obtaining Subscribers, or by forwarding information relating to their proceedings, for publication in its pages.

AMENDMENTS TO ACT.

The draft of Bill to amend that portion of the Act constituting this board, and the Management of the Provincial Exhibition, as adopted at the last Annual Meeting and submitted to the Legislature, was published in the April number of the Journal, and the result fully reported upon by your Committee at the July meeting of the Board, as per minutes published in the Journal for August.

At the Annual Meeting of the Provincial Exhibition Association, held in London, in September last, it was Resolved—

"That the Board of Agriculture are hereby requested to give notice to the several Electoral Division Agricultural Societies to send up each one delegate to attend a meeting to be held in Toronto the month preceding the meeting of the Legislature, for the purpose of agreeing upon, and recommending, such alterations as they may deem necessary in the Agricultural Statute, and that the Board of Arts and Manufactures, and the Horticultural Societies be invited to attend; and in order more fully to carry out the spirit of the foregoing resolution, a synopsis of the Bill introduced at the last meeting of the Legislature be published, and a copy thereof sent to each County and Electoral Division Society, in order that the delegates may have a thorough knowledge of the subject under discussion; and that the travelling expenses of such delegates be paid out of the general funds of the Association, and that the President of the Board of Agriculture be authorized to name the day, and place of meeting by circular."

Your Committee therefore recommend that the Board now discuss such amendments as they may deem it desirable to propose; and that the Members of the Board attend the meeting of delegates, which has been called for Thursday the 30th of January instant, at noon, at the Rooms of the Board of Agriculture, King street West, Toronto.

INTERNATIONAL EXHIBITION OF 1862.

In answer to the urgent representations of the Boards of Arts and Manufactures, and the Boards of Agriculture, for Upper and Lower Canada, the Government appointed a Commission—of which the President of this Board is a member—for the purpose of obtaining a representation of this Province at the International Exhibition of 1862.

Your Committee have used every available means, by publishing the official announcements of the Commissioners, and appeals to Manufacturers and others through the pages of the Journal, and the issusing of 3000 extras, urging upon them to prepare and send in their contributions at the time and place named for their reception; and also by instructing their Agents, who have been and are now canvassing for the Journal, specially to canvas for specimens for the Exhibition, and to obtain, if possible, the formation of Committees for the same purpose, in the several localities they may visit.

ESSAY ON MANUFACTURES.

As the result of the offer of two Prizes by the Board, of $150 and $75 respectively, for the best two Essays on "The Manufactures which are best suited to the circumstances and capabilities of Upper Canada," but one production was sent in. The gentlemen who kindly consented to act as Judges thereon, reported that—"They do not find it such as, in their judgment, to warrant their awarding to it either of the Prizes offered, or recommending its publication as likely to subserve the ends, which they presume the Board of Arts and

Manufactures to have had in view, in the appeal made by them to the Country's mind. At the same time, as the Essay affords evidence both of the bestowal of attention on the subject, and of a commendable interest in it, it may be a question for the consideration of the Board whether it might not be advisable to mark in some way their appreciation of these qualities, and how this might best be done."

All which is respectfully submitted,

W. Edwards, *Secretary.* John Beatty, *Junior, President.*

TORONTO MECHANICS' INSTITUTE.

We are much gratified to witness the success attending the extraordinary efforts of the successive Managers of this Institution, for the past few years, in the erection and completion, in all its details, of the noble building which it now occupies; costing, at the lowest calculation, including the land it stands on, not less than fifty thousand dollars; and with a debt remaining upon it of only nineteen thousand.

The last heavy item of expense was that of heating by steam. The contract for this work was taken by Mr. James E. Thompson, of this city, at a cost of something over two thousand dollars, and is guaranteed to heat the entire building (80 feet by 104 feet, and three stories high) to seventy-five degrees.

The whole of the first floor is sufficiently heated in the coldest weather, by a pressure of from three to five pounds of steam, and the upper floor and music hall with from six to ten pounds. We are also informed by the officers in charge, that it is easily managed by the House-keeper of the Institute, is perfectly secure from fire, and is expected to be very economical in the consumption of fuel (anthracite coal), not using one half the quantity that would be required to heat by any of the ordinary methods.

We can speak from personal knowledge of the agreeable heat at all times pervading the building, so different from the atmosphere of rooms heated by ordinary stoves, or hot-air furnaces.

In incurring the expense of these works, the Directors exceeded their available balance by about a thousand dollars; but some few Ladies connected with the Institute, came nobly forward, and got up a Bazaar, which was held during the Christmas holidays, and realized the handsome sum of about four hundred dollars towards relieving the Directors from this difficulty.

Since the Institute took possession of the building, in July last, the membership has nearly doubled, and now numbers about eleven hundred. This is not to be wondered at, when we state that all its privileges—including an excellent Reading Room, and a Library of upwards of five thousand volumes—are secured for the small sum of two dollars a year. The number of members regularly taking books out of the Library is upwards of eight hundred.

Besides the Rooms permanently rented to the Board of Arts and Manufactures, and to Messrs. Roaf and Davis for Law offices, the Institute is deriving a large revenue from its beautiful Music and Lecture Halls, and the various other smaller rooms. for which there is a constant demand.

A Chess Class of about sixty members, and Classes for Mechanical and Free-hand Drawing and Painting, are in operation in connection with the Institute. The number of Classes we hope to see largely increased during another winter session, as we look upon this department of a Mechanics' Institute's operations as one of very great importance.

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE DURING THE PAST MOMTH.

CLASS II.

Roman and Greek antiquities, with nearly 2000 illustrations; 12mo; 1860........ *A. Rich.*

CLASS VI.

Pictorial Gallery of the Fine and useful Arts; 2 Vols., folio; London, 1847.......

CLASS VII.

Dictionary of Machines, Mechanics, Engine-Work and Engineering, with 4000 Engravings; 2 Vols., 8vo; 1861 .... *Appleton & Co*

Dictionary of Roman and Greek Antiquities, with nearly 200 Engravings; 12mo; 1860.................... *A. Rich.*

English Dictionary; 12mo; 1845.................... *H. Reed.*

French and English Dictionary; 12mo; 1861.................... *Spiers & Surenne*

German and English Dictionary; 12mo; 1861 .... *G. J. Adler.*

Spanish and English Dictionary; 12 mo; 1861.................... *Seoane, Newman & Barretti.*

CLASS XV.

Year Book of Facts in Science and Art, Exhibiting all the most important Discoveries in Mechanics and the useful Arts; Natural Philosophy; Electricity; Chemistry; Zoology and Botany; Geology and Mineralogy; Meteorology and Astronomy; 23 Vols., 12mo; complete from the beginning; 1839 to 1861.. *John Timbs, F. S. A.*

CLASS XVII.

Naval and Mail Steamers of the United States; folio; 1853............................ *Charles. B. Stuart.*

THE DEATH OF PRINCE ALBERT.

In respectful memory of the death of one so much endeared, by a singular variety of associations in public life, to all who live under British rule, the death of Prince Albert has been the painful subject of an Address to Her Majesty the Queen by the Society of Arts in England.

The sympathies expressed by the Society will be felt by all kindred institutions in alliance with that body, or working, however humbly, in the same field.

ADDRESS

TO THE QUEEN'S MOST EXCELLENT MAJESTY.

We, your Majesty's most dutiful and loyal subjects, the Society for the Encouragement of Arts, Manufactures, and Commerce, incorporated by Royal Charter, humbly approach your Majesty, with the assurance of our devoted attachment to your throne and person, and of our respectful sympathy with your Majesty in the great affliction which has so unexpectedly befallen your Majesty and the Nation, in the early death of His Royal Highness the Prince Consort.

Whilst the death of a Prince, distinguished by rare intellectual gifts and eminent virtues, is deeply lamented by all classes of your Majesty's subjects, his loss is especially deplored by this Society, which has for many years enjoyed the great advantage of his judicious counsel and support.

His Royal Highness was elected President in 1843.

His high position, his refined tastes, his enlightened judgment and his candour; his great command of general principles and his power of applying them to details; and his special knowledge on a great variety of subjects, extended the influence and greatly promoted the objects of the Society. Science, Art, and Literature, were, by his judicious patronage, constantly introduced to the notice and recommended to the favour of your Majesty.

The great conception of the Exhibition of 1851, with its countless influences on the progress of human industry, was due to His Royal Highness, and in overcoming the difficulties of such a new and gigantic work, he solved the problem of conducting future Exhibitions, and their success will be an ever-recurring memorial of their author.

The Society can never forget the obligations which His Royal Highness has conferred on them, and they humbly express a hope that the recollection of his virtues and of his public services may, with God's help, in some measure soften the intensity of your Majesty's affliction.

That your Majesty may long reign over a loyal and devoted people, is the prayer of your dutiful and loyal subjects and servants.

By order of the Council, sealed with the seal of the Society for the Encouragement of Arts, Manufactures, and Commerce, this twenty-seventh day of December, one thousand eight hundred and sixty-one, in the presence of

P. Le Neve Foster, *Secretary.*

CANADIAN PATENTS.

Bureau of Agriculture and Statistics, Quebec, 28th December, 1861 :—

Henry Yates, of Brantford, Assignee for the residue of the unexpired period of a certain patent granted to one James McLellan, on 15th December, 1855, for "A new machine for the repairing of iron rails used for cars and carriages to run upon railways."—(Dated 16th February, 1861.)

William Douglas Westman, of the township of King, in the County of York, Machinist, for "An improved screen for Fanning Mills."—Dated 12th March, 1861.

Henry W. Ostrum, Yeoman, and Joseph Sutton, Machinist, both of the township of Sidney, in the County of Hastings, for "An improved Fanning Mill."—(Dated 12th March, 1861.)

Henry W. Ostrum, Yeoman, and Joseph Sutton, Machinist, both of the township of Sydney, in the County of Hastings, for "An improved Churning Gear."—(Dated 12 March, 1861.)

Wm. Douglas Westman, of the township of King, in the County of York, Machinist, for "An improved Lever for Fanning Mills."—(Dated 12th March, 1861.)

Albert O. Fuller, of the township of Erin, in the County of Wellington, Millwright, for "A new and portable Labor Saving Machine for cutting mortices in carriage and all other hubs, by hand." —(Dated 21st March, 1861.)

Calvin Bently, of the township of Pickering, in the County of Ontario, Joiner, for "An Eave Trough and Finish."—(Dated 21st March, 1861.)

William Watson, of the township of Vaughan, in the County of York, Watchmaker, for "An improvement in the Manufacture of Oil Gas."—(Dated 23rd March, 1861.

William Brown and Jesse Weaver, both of the township of Malahide, in the county of Elgin Farmers, for, "An evaporating furnace."—(Dated 23rd March, 1861).

Hubbard Joslyn, of the township of Stanstead, in the county of Stanstead, Mechanic, for "An improved machine for wringing clothes, to be called "Joslyn's improved Clothes Wringer."—(Dated 4th April, 1861.)

John Carter Park, of the town of Brantford, in the County of Brant, Mechanical Engineer, for "A machine for removing snow and ice from railway tracks."—(Dated 9th April 1861.)

Germain M. Cossitt, Newton Cossitt, and Alexander Young, of the village of Smith's Falls, in the county of Lanark, Iron Founders and Machinists, for "An improved Reaper Attachment."—(Dated 10th April, 1861.

George Ives, of the town of Windsor, in the County of Essex, for "An improved Saw Horse." —(Dated 10th April, 1861.)

George Robinson, of Drummondville, in the County of Welland, Miller, for "An improved extension Clothes Horse."—(Dated 10th April, 1861.)

Alexander Fraser Cockburn, of the city of Montreal, Brass Founder and Finisher, for "A compression Swivel Action Water Cock."—(Dated 11th April, 1861.)

Richard Hill, of the town of Port Hope, in the county of Durham, Plough Maker, for "an improved Plough."—(Dated 17th April, 1861."

Henry Lehan, of the township of Reach, in the county of Ontario, Manufacturer, for "The Farmers improved Hay Rake."—(Dated 17th April, 1861.)

David Henri Tetu, of Riviere Ouelle, Trader, for "A fishing apparatus in deep Water."—(Dated 18th April, 1861.)

Jas. P. Davidson, of Belleville, in the County of Hastings, Agricultural Implement Maker, for "An improved Power for Churning, Pumping and Washing."—(Dated 20th April, 1861.)

John Abner Burton Hannum, of the town of Cornwall, in the County of Stormont, for "A Churn Power."—(Dated 25th April, 1861.)

We purpose publishing in each number of the Journal a selection from the London *Mechanics' Magazine* (a valuable periodical, with but limited circulation in this country) of abridged specifications of such English patents as may be deemed useful or interesting to our Canadian readers.

Full specifications of all English patents issued may be obtained on application to Bennet Woodcroft, Esq., Great Seal Patent Office, 25 Southampton Buildings, Holborn, London; the price of which—varying from 3d. to 5s. sterling—must be remitted by Post Office order, made payable at the Post Office, Holborn.

Lists of all specifications may be seen at the Free Library of Reference of the Board of Arts and Manufactures, Toronto, as published in the Commissioner of Patents Journal.

We shall use our best endeavors to obtain for publication abridged specifications of patents issued in Canada, so as to make this department of our Journal as interesting as possible to Canadian manufacturers and inventors.

ABRIDGED SPECIFICATIONS OF ENGLISH PATENTS.

1022. J. Rhodes and R. Kemp. *Improvements in rag machines.* Dated April 24, 1861.

This consists in applying a toothed roller or rollers over or above the feed rollers in near contact with the teeth or points of the swift or cylinder for stripping or removing the untorn rags therefrom which rags, by other rollers placed in contact therewith, are carried back to the feed apron, which again passes them through the feed rollers to the swift, to be again operated upon. *Patent completed.*

1029. G. Scott. *Improvements in steam engines and their apparatus for generating steam.* Dated April 25, 1861.

This relates to oscillating cylinders, and consists in making the trunnion bearings hollow, with suitable openings in the bearings for the admission to, and withdrawal of the steam from either of the sides of the piston. The bed-plate is made hollow to be used as a steam chest, from whence the steam is admitted to the cylinder through the openings in the bearings. The invention also relates to a mode of exposing the exhaust steam from the cylinder to

the cooling and condensing action of cold water or air, and also to the mode of construction of the condenser. The invention also relates to a means for saturating highly superheated steam. There are other features included. *Patent completed.*

1035. W. Harris. *Improvements in treating hides and skins, to render them suitable to be made into straps for driving machinery, and to be used for other purposes for which leather is commonly employed.* Dated April 25, 1861.

Here the hide is first soaked in milk, then drained, and placed in a bath of tar; it is next removed from the tar bath, scraped, dried, and finally dressed with dubbing as usual. *Patent completed.*

1056. J. Dellegana. *Improvements in apparatus for embossing and taking casts or matrices for stereotype and other purposes.* Dated April 26, 1861.

This consists in the use of rollers in combination with a table supporting the article to be embossed, such table being geared with a pressure roller, so that the surface speed of the pressure roller shall be the same as that of the table. *Patent completed.*

1057. E. H. Joynson. *Improvements in machinery for the manufacture of paper.* Dated April 26, 1861.

This consists, 1, in a machine for washing rags preparatory to converting them into pulp. 2. To an improvement in that part of the paper machine at which the pulp is supplied to the wire. 3. To a novel arrangement of apparatus for the sizing of paper. We cannot here quote the details of the invention. *Patent completed.*

1071. J. Mash. *Improvements in steam engines.* Dated April 29, 1861.

This consists in rendering available for power the impulsive force due to the velocity of steam, by causing steam to act on the ordinary or other pistons of steam engines in jets. *Patent completed.*

1078. G. Hulme. *An improvement or improvements in the process of carding wool, cotton, silk, or fibrous materials, and in machinery or apparatus applicable for that purpose.* Dated April 30, 1861.

This consists in imparting certainty and regularity to the motion of the creeper, by making a positive connection between it and its driving roller, by means of interlocking projections and depressions, pins, teeth, or other mechanical means. *Patent completed.*

1079. J. Meyer. *Certain new chemical combinations, and for the application thereof to fixing aniline and pigment colours in printing and dyeing, to tanning, waterproofing and other industrial purposes.* (A communication.) Dated April 30, 1861.

This consists in the combination of certain organic substances, such as albumen, fibrine, glue, animal tissues, and other analogous substances with the oxide or salts of tungsten or niolybdenum. *Patent completed.*

1081. W. Horn. *Improvements in steam and water-tight joints for fixing tubes in plates, such as used for surface condensers, distillers, refrigerators, vessels for heating feed water or tubular boilers.* (A communication.) Dated May 1, 1861.

The novelty here is the use of rings or short tubes of compressed wood for making water and steam-tight connections between tubes and plates, such as are used for surface condensers and other apparatuses. *Patent completed.*

1096. W. Scholes. *Improvements in carding engines for carding wool, cotton, silk, or other fibrous stances.* Dated May 2, 1861.

This consists in making the periphery or surface of the "licker in," or in covering the same with portable wood bags, which the patentee sets with steel or other metal pins or points. *Patent completed.*

1097. W. Hoyle. *Certain improvements in machinery for preparing, spinning, and doubling cotton and other fibrous substances.* Dated May 2, 1861.

The patentee claims the application of pressure to top rollers by means of a weight, which remains stationary while the endless band revolves round the top roller, and round a pulley or pulleys to which the weight is suspended or connected as described. *Patent completed.*

1117. W. E. Newton. *Improvements in the treatment of copper ores.* (A communication.) Dated May 3, 1861.

Here the pyrites are first pulverized, and then, by ordinary fluxes and sulphur, and chloride of lime, the ore, whether roasted or not, may be operated upon. In the use of roasted ore a certain weight of the ore is to be mixed with variable quantities of sulphur and chloride of lime according to the richness of the ore, and the nature of its gauge. *Patent completed.*

NOTICES OF BOOKS.

The Physical Geography of the Sea, by Lieutenant Maury, *late of the U. S. Navy, and Superintendent of the National Observatory. Sixth edition. 1 vol., 8vo. New York: Harper & Brothers. Toronto: Rollo & Adam.*

In accordance with our design of noticing in this journal books suitable in an especial degree for the Libraries of Mechanics' Institutes, we desire in the present issue to draw the attention of our readers to a work which has been long and favourably known to the public in general, as is testified by its having lately reached a sixth edition, but which, nevertheless, is still replete with much that is novel and interesting to all who have not already made acquaintance with its pages.

Under the title of the "Physical Geography of the Sea," the author includes all that relates to the vast domain of waters upon the earth—the oceans, seas, and lakes, into which they are distributed, with their various depths and temperature; the circulation of the atmosphere, and of the ocean; the phenomena of the tides, and of the winds; the mysterious effects of electric and magnetic forces; the laws of evaporation, and the variations of climate in the different latitudes of the watery world—all, in short, that relates to the economy of the sea and its adaptations. A vast and comprehensive subject truly, and one which embraces within it operations of great importance

not only to the principles and practice of navigation, but also to the general interests of the world.

The Atlantic Ocean is the especial object of our author's labours, and occupies a large portion of his volume; the first two chapters, indeed, are devoted to a single current in it—the Gulf-stream—some of the most peculiar features of which he beautifully describes in the following passage:—

"There is a river in the ocean. In the severest droughts it never fails, and in the mightiest floods it never overflows. Its banks and its bottom are of cold water, while its current is of warm. The Gulf of Mexico is its fountain, and its mouth is in the Arctic Seas. It is the Gulf Stream. There is in the world no other such majestic flow of waters. Its current is more rapid than the Mississippi or the Amazon, and its volume more than a thousand times greater. Its waters, as far out from the Gulf as the Carolina coasts, are of an indigo blue. They are so distinctly marked that their line of junction with the common sea-water may be traced by the eye. Often one half of the vessel may be perceived floating in Gulf Stream water, while the other half is in common water of the sea; so sharp is the line, and such the want of affinity between those waters, and such, too, the reluctance, so to speak, on the part of the Gulf Stream to mingle with the common water of the sea."

There are other features no less striking and peculiar to be observed in this wonderful ocean-stream—features so remarkable that it will not be unprofitable to consider them somewhat in detail. The general aspect of the Gulf-stream is that of a strong and rapid river, as it were, flowing forth from the Mexican Gulf and Carribean Sea, and passing round the southern coast of Florida. It then proceeds to the north-east in a line almost parallel to the coast of the United States, as far as the Grand Banks of Newfoundland; here, being unrestrained, it widens its bounds, and slackens its speed, though such is its impetus that even to the coasts of Great Britain and Ireland, the Norwegian shores, and down to the Bay of Biscay, this mighty marine river continues to roll its wonderful waters. Throughout its course of many thousand miles it preserves its remarkable physical characters—the only change it undergoes being that of degree. As its waters gradually mingle with those of the surrounding ocean, their deep blue tint becomes more faint, their temperature diminishes, and the speed with which they advance declines. When the stream first emerges from the Gulf, and passes through the Channel of Bemini, its velocity is about 4 miles an hour; when it reaches Cape Hateras, having attained a breadth of 75 miles, its speed is reduced to 3 miles an hour; and on its arrival at the Banks, it is still further diminished to 1½ miles an hour. Its temperature also undergoes a corresponding change. In the Straits of Florida it has been observed as high as 88° 52′ Fah.; in latitude 40° its warmth is still about 25° above that of the surrounding ocean. And even when it reaches the coasts of Northern Europe, its heat, though much diminished, is not altogether lost; as far north, indeed, as the polar basin of Spitzbergen its waters are 6 or 7 degrees warmer than those around them. To quote our author's words—"it is the influence of this stream that makes Erin the 'Emerald Isle of the Sea,' and that clothes the shores of Albion in evergreen robes; while in the same latitude on this side, the coasts of Labrador are fast bound in fetters of ice." He declares also, that "the quantity of heat discharged over the Atlantic from the Gulf Stream in a winter's day, would be sufficient to raise the whole column of atmosphere that rests upon France and the British Isles from the freezing point to summer heat."

Many theories have been put forward with regard to the causes that produce this vast and important stream. Some rest upon very iusufficient grounds, and others are palpably absurd. It is now, however, generally agreed that one main influence which puts it in motion is "the tendency of the polar and equatorial waters to equalize their temperature by currents flowing at different depths through the ocean." Another cause, which combines with the foregoing, and produces the north-easterly flow of the current, is the daily rotation of the earth upon its axis. In addition to these, there must also be taken into consideration the influence and action of the atmosphere, the tides, and the variations of temperature in different regions. The trade winds, too, no doubt, perform their share of the task of keeping up the flow of this vast stream, which carries to the northern parts of the eastern hemisphere the warmth derived from the perpetual summer of the equatorial seas.

But our limited space forbids our dwelling any longer upon this very interesting subject; we must be content merely to draw the attention of our readers to some of its most remarkable features, a full acconnt of which can be found in the work itself. Other topics, too, of interest and importance to all, are discussed in the volume before us; foremost among which may be mentioned that of the atmosphere in its various relations to the physical geography of the sea, as displayed in the winds, rains, and fogs, and in the phenomena of evaporation and electrical changes. Next, we have an account of the Salts of the Sea; the Geological Agency of the Winds; the Depths of the Ocean, with a description of the apparatus for determining them; the "Telegraphic Plateau" of the Atlantic; the Winds and Storms; the Climate of the Ocean; its Drift; and the Routes commonly ob-

served in traversing it. Such is a brief enumeration of the various subjects so graphically described by our author; subjects alike interesting and instructive to all who desire to look into "the wonders of the great deep."

We cannot better conclude than by quoting our author's remarks with regard to the design of his work. "No expression," he states, "uttered, nor act performed by the agents of nature upon our planet, is without meaning. The wind and rain, the vapor and the cloud, the tide, the current, the saltness and depth, and warmth, and color of the sea, the shade of the sky, the temperature of the air, the tint and shape of the clouds, the height of the tree on the shore, the size of its leaves, the brilliancy of its flowers—each and all may be regarded as the exponent of certain physical combinations, and therefore as the expression in which nature chooses to announce her own doings, or, if we please, as the language in which she writes down or chooses to make known her own laws. To understand that language and to interpret aright those laws is the object of the undertaking which we have now in hand. No fact gathered in such a field as the one before us can therefore come amiss to those who tread the walks of instructive philosophy; for, in the hand book of nature, every such fact is a syllable; and it is by patiently collecting fact after fact, and by joining syllable after syllable, that we may finally seek to read aright from the great volume which the mariner at sea, as well as the philosopher on the mountain, each sees spread out before him."

The Works of Francis Bacon, Baron of Verulam, Viscount St. Albans, and Lord High Chancellor of England. Collected and Edited by JAMES SPEDDING, M.A., *of Trinity College, Cambridge:* ROBERT LESLIE ELLIS, M.A., *late Fellow of Trinity College, Cambridge; and* DOUGLAS DENON HEATH, *Barrister-at-Law, late Fellow of Trinity College, Cambridge. Volume II. Boston: Brown & Taggard. Toronto: Rollo & Adam.* 12*mo. pp.* 503.

We lately noticed the publication of the first volume of this magnificent edition of Lord Bacon's Works. The second volume, now before us, is a continuation of the first part of his Philosophical Works, and contains the *Parasceve ad Historiam Naturalem et Experimentalem*, and the *De Augmentis Scientiarum*, with a preface to each by Mr. Spedding. In the preface to the *Parasceve*, the editor gives an interesting account of what are, to a great extent, the distinctive peculiarities of Bacon's philosophy, the main foundation of which he himself considered to consist in "the compilation of a natural and experimental history;" in fact, it was for the purpose of obtaining assistance in this design that he published his *Novum Organum* in so imperfect a shape.

We have already alluded, in our former notice, to the typographical excellence and beauty of this edition, and to the credit it reflects upon the enterprising publishers; it only remains for us now to express our sincere hope that in the present state of things on this continent, so unfavourable as it is to all literary undertakings, the publication of this work may not prove to them a source of loss and disappointment.

BRITISH PUBLICATIONS FOR OCTOBER.

				Stg. Prices.
Abbeys and Attics, by Julian Strickland, 2 vols. cr, 8vo	0	12	0	*Freeman*
Abraham (The Life of): Bible Readings, by A. H. L., fcap. 8vo	0	3	6	*Hogg*
Addison (Julia) Crow's Nest Farm: a True Tale. post 8vo	0	10	6	*Saunders & O.*
Angus (Joseph, M.A.) Handbook of the English Tongue, 12mo.	0	5	0	*Rel. Tr. Soc.*
Arendts (Dr. Carl) Practical Aids to Study of Natural History, Botany, &c., trans., roy. 8vo	0	3	6	*Ward & Lock*
Aylmer (Mrs. J. E.) Distant Homes: or, Graham Family in New Zealand, 16mo	0	3	6	*Griffith & Far.*
Bailey (Philip James) International Policy of the Great Powers, fcap. 8vo	0	6	0	*Saunders & O.*
Bain (Alex.) On the Study of Character, with an Estimate of Phrenology, 8vo.	0	9	0	*Parker & Son*
Barnes (Wm.) Tiw, a View of the Roots, &c., of the English as a Teutonic Tongue, fcap. 8vo	0	5	0	*J. R. Smith*
Beamont (W. J.) Concise Grammar of the Arabic Language, 12mo	0	7	0	*Bell & Daldy*
Berlepsch (H.) The Alps; Sketches of Life and Nature in the Mountains, translated, 8vo	0	15	0	*Longman*
Bohn's English Gentleman's Library.—Walpole's Letters, Vol. 8, 8vo	0	9	0	*Bohn*
Boner (Charles) Forest Creatures, illust., post 8vo	0	10	6	*Longman*
Book (The) of Field Sports, edited by H. D. Miles, Div. 1, Vols. 1 and 2, roy. 4to, each	0	13	6	*Lea*
Brewer (Rev. Dr.) Guide to Roman History, to close of Western Empire, 3rd edition, 18mo	0	3	6	*Jarrold*
Campin (F.) Diagrams to Facilitate the Calculation of Iron Bridges, obl. 4to.	0	2	6	*Spon*
Cavour: a Memoir, 2nd edition, by Edward Dicey, cr. 8vo	0	6	6	*Macmillan*
Chorley (Henry F.) Authors of England, a Series of Portraits with Notices, new edition, imp., 8vo	0	10	6	*Griffin*
Cooks (M. C.) Manual of Structural Botany, for Classes, Schools, &c., 18mo.	0	1	0	*Hardwicke*

				Stg. Prices.
Cox (F. A.) Geography and Natural History of Palestine, cr. 8vo, reduced to.	0	2	0	*Griffin*
———— Manners and Customs of the Israelites, cr. 8vo, reduced to........	0	2	0	*Griffin*
De Boileau (Lambert) Recollections of Labrador Life, post 8vo....................	0	7	6	*Saunders & O.*
Fairbairn's Crests of Great Britain and Ireland, by Butters, 2 vols., roy. 8vo. reduced to £3 3s. tinted..........	3	13	6	*Hamilton*
Footsteps of Shakspeare, a Ramble with the Early Dramatists, post 8vo.......	0	5	6	*J. R. Smith*
Gosse (Philip H.) Romance of Natural History, Second Series, post 8vo.......	0	7	6	*Nisbet*
Gray (Mrs. H.) History of Rome, Vol. 1: Republic, 12mo, reduced to.........	0	6	0	*Hatchard*
———————— 2: Emperors, 12mo, reduced to.........	0	6	0	*Hatchard*
Grub (George, A.M.) Ecclesiastical History of Scotland, 4 vols. 8vo	2	2	0	*Edmonston*
Howitt (William and Mary) Ruined Abbeys and Castles of Great Britain, fcap. 4to..........	1	1	0	*Bennet*
Interviews (The) of Great Men, by the Author of "Heroines of our Time," &c., post 8vo..........	0	6	0	*Darton*
Johnson (Samuel) Life of, by James Boswell, Notes by Malone, n. edit. 8vo.	0	5	0	*Griffin*
Journal of Horticulture (The), Cottage Garden, &c., v. 1, new series, imp. 8vo	0	8	6	*Office*
King Arthur and his Knights of the Round Table, comp. by J. T. K. cr. 8vo.	0	7	0	*Griffith & Far.*
Makins, (George Hogarth) Manual of Metallurgy, post 8vo........................	0	12	0	*Ellis*
Manual of Field Artillery Fxercises, Horse Guards, August 1, 1861, 8vo......	0	5	0	*Parker & Son*
Miller (W. H.) Treatise on Crystallography, 8vo, advance to.....................	0	9	0	*Parker & Son*
Moberly (George) On the Studies and Discipline of Public Schools..............	0	2	6	*Rivingtons*
Napier (Admiral Sir C.) Life and Correspondence, by Major-General Elers Napier, 2 vols. 8vo..........	1	10	0	*Hurst & Black*
Nelson, Life of, by Robert Southey, 24mo, sd. 2s. 6d..............................	0	3	0	*Bell & Daldy*
Rarey (J. S.) Art of Taming Horses, new edition, fcap. 8vo......................	0	3	0	*Routledge*
Ravenstein (E. G.) Russians on the Amur: its Discovery, Conquest, &c., 8vo.	0	15	0	*Trübner*
Riego (Mddle.) Waved Crochet Braid Antimacassars and Doyleys, obl. 16mo.	0	0	6	*Simpkin*
Roberts (Browne H. E.) History of the Colonial Empire of Great Brit., p. 8vo	0	7	0	*Longman*
Robertson (George) Compendium of Latin Syntax, 12mo........................	0	1	0	*Hamilton*
———— (Rev. Fred. W.) Lectures and Addresses on Literary Topics, new edition, fcap. 8vo..........	0	5	0	*Smith & Elder*
Rogers (Rev. Charles) Familiar Illustrations of Scottish Character, fcap. 8vo, reduced to..........	0	2	6	*Griffin*
Smiles (Sam.) Lives of Engineers, with an Account of their Works, &c., vols. 1 and 2, 8vo..........	2	2	0	*Murray*
Temple (J. A.) English and French Money and Measurement, 12mo............	0	1	0	*Temple*
Templeton (Wm.) Millwright and Engineer's Pocket Companion, 13th edit., revised, 12mo..........	0	5	0	*Simpkin*

AMERICAN PUBLICATIONS FOR NOVEMBER.

Brimley.—Essays by the late George Brimley, M.A., Librarian of Trinity College, Cambridge: with an Introduction, by R. H. Stoddard. 12mo, pp. 409......	$1	25	*Rudd & Carl.*
Jenkins' Vest Pocket Lexicon. An English Dictionary of all except Familiar Words; including the principal Scientific and Technical Terms, and Foreign Moneys, Weights and Measures. Omitting what every body knows, and containing what every body wants to know, and cannot easily find. By Jabez Jenkins. 64mo, pp. 563..........	0	50	*Lippincott & Co*
McClellan.—European Cavalry, Including the details of the Organization of Cavalry Service among the Principal Nations in Europe. By George B. McClellan, Major-General U. S. Army. Fully Illustrated. 12mo, pp. 214.	1	25	*Lippincott & Co*
Poe.—The Poetical Works of Edgar Allan Poe. With an Original Memoir. Blue and gold, pp. 278..........	0	75	*W.J. Widdleton*
Poe.—The Works of Edgar Allan Poe in four Volumes, 12mo........................	5	00	*W.J. Widdleton*
Saxe.—Poems. By J. G. Saxe; complete in 1 Vol. 18mo, blue and gold, pp. 308	0	75	*Ticknor & Field*
Scott.—Tales of a Grandfather. By Sir Walter Scott, 6 Vols. Vols. III., IV., V., VI., 16mo, each..........	0	75	*Ticknor & Field*
Titcomb.—Lessons in Life. A Series of Familiar Essays. By Timothy Titcomb, Author of "Letters to the Young," "Gold Foil," &c. Fifth Edition. 12mo, pp. 344..........	1	00	*Chas. Scribner*
Warren.—A Manual of Elementary Geometrical Drawings, involving Three Dimensions. Designed for the use of High Schools, Academies, Engineering Schools, &c.; and for the Self-Instruction of Inventors, Artizans, &c. In Five Divisions. Div. 1. Elementary Projections. Div. 2. Details of Constructions in Masonry, Wood and Metal. Div. 3. Rudimentary Exercises in Shades and Shadows. Div. 4. Isometrical Drawing. Div. 5. Elementary Structural Drawing. By S. Edward Warren, C. E., Professor of Descriptive Geometry and Geometrical Drawing in the Rensselaer Poletechnic Institute, Troy, N. Y.; and author of a Treatise on the Orthographic Projections of Descriptive Geometry. 8vo, pp. 105.	1	00	*John Wiley*

Selected Articles.

FLAX CULTIVATION IN CANADA.

In the present aspect of affairs, attention is being turned to other staples than cotton for a supply of fibre suitable for textile fabrics. The soil and climate of Canada are well adapted to the cultivation of flax, and it is to this fibre-producing vegetable that the thoughts of farmers should now be directed. We intend to publish, in successive numbers of this journal, short articles* on the preparation of flax, leaving the details of its cultivation to the pages of the AGRICULTURIST, in which numerous articles on the preparation of the soil necessary for this valuable plant have already appeared, and which should be carefully studied by those who intend to grow it. As there are no other products of the farm which promise so fairly as the one under review, it is not improbable that flax cultivation may become general in Canada.

Sowing.

The seed generally preferred is Riga; it seems adapted to most soils. Dutch is occasionally used with great success; but the American seed does not generally suit well, being apt to produce a coarse, branchy stem, which skilful flax-growers aim against as much as possible. *A tall, tapering, firm stem, with few branches, and those not spreading, are considered good signs in a crop of flax.*

If the American seed be used, it should be sown in a deep, loamy soil. In selecting seed, care should be taken that it is plump, shining, and heavy; and if it be of foreign growth, the character of the merchant from whom it is purchased, and the brand by which its quality is known, ought both to be attended to. Care, as we have just observed, must be taken to have it well sifted, to clear it of the seeds of weeds which are often mixed with it, and which, if not removed, cause a great deal of subsequent labour when the crop is growing. The process of separation is generally effected by fanners and a wire-sieve, which has twelve bars to the inch. Home-saved seed is occasionally used, and produces excellent crops; but it is highly necessary to select a good quality, otherwise the result will be anything but favourable. The time, however, will come, it is to be hoped, when the bulk of home-raised seed can be used for sowing instead of foreign.

The produce of seed averages about twelve bushels the statute acre; so that the seed off one statute acre would sow about five. When flax is thinly sown it produces much seed; it is therefore better to sow thick, which causes, in general, the stem to grow tall and straight, with only one or two seed capsules at the top. The fibre is also much superior, in fineness and length, to that produced from thin sown flax, which grows coarse, branches out, and bears a great quantity of seed. Under good cultivation, after the ground is pulverized and well cleaned, it is rolled and sown; and, if laid without ridges, it is marked off in divisions, eight to ten feet broad, in order to give an equable supply of seed. After sowing, the ground is covered with a seed-harrow, which goes over it three times—once up, once down, and once across, or anglewise, in order that the seed should be equally spread, and the small drills made level by the teeth of the harrow. The ground is finished with a roller, which covers the seed about an inch, the depth generally considered the best for growing freely. When the ridges are too much raised in the centre, at the time of sowing, it is liable to injure the crop, preventing it from growing equally; but when the land is properly drained, no ridges are required. The sowing of clover and grass-seeds along with the flax is rarely considered judicious, and ought, if possible, to be avoided, as those plants injure the root-ends of the flax. Carrots are occasionally sown in drills, in suitable soils, which enables the individual pulling the flax to step over the rows, which are afterwards hoed and cleaned, and receive some liquid manure. In the case, however, of rolling the ground, after sowing, care should be taken not to roll when it is wet, as the mould is liable to stick to the roller.

Pulling.

The time for pulling the flax is a point of great importance. The fibre is in the best state before the seed is quite ripe. If pulled too soon, though the fibre be fine, there is great waste in scutching and hackling, which renders the crop unprofitable; and if pulled too late, the additional weight of the fibre rarely compensates for its coarseness. The best time for pulling, however, is when the seeds begin to change from a green to a pale brown, and the stalk to a yellow colour, to about two-thirds of its length. When any portion of the crop is lying, and suffering from wet, it should be pulled as soon as possible, and kept separate from the other. Whenever the flax is of unequal length, from the land being imperfectly drained and levelled before sowing, each length should be pulled separately, and steeped in a separate pool, or kept from the other in the same pool. If there be a large second growth, the flax should be caught by the puller just underneath the bolls, so as to leave the short stalks behind; and if there be not many of the latter, it is better to leave them on the ground, as the mixture and discoloration are apt to deteriorate the crop. If the ground has been thoroughly drained, and laid out evenly, the flax in general will be all of the same length; but it is necessary to keep the flax even at the roots, which increases its value both to the spinner and to the grower, and amply repays the trouble bestowed upon it.

Rippling.

The handfuls of flax, when pulled, should be laid across each other diagonally, to facilitate the process of rippling, which should be carried on at the same time, and in the same field. Rippling the flax not only renders it easier to be handled, but saves the seed, which is a valuable portion of the crop. If the seed be sold for the oil, it realizes about £3 to the acre; but if used for feeding purposes, it is worth about £4. The ripple is composed of a row of iron teeth, screwed into a block of wood; when used, it is taken to the field where the flax is pulled, and screwed down to the centre of a nine-feet plank, resting on two stools.

* Richardson's Rural Handbooks.

The ripplers may either stand, or sit astride at opposite ends of the plank; but they must be sufficiently near to the comb, to enable them to strike the flax properly and alternately. A winnowing-sheet should be placed under them, to receive the bolls as they are rippled off. The ripplers, moreover, should be sufficiently near to receive the flax as it is pulled and laid down at their right hand in sheaves. When the sheaf is untied the rippler takes up a certain quantity, holding it about six inches from the root with one hand, and near the top with the other. He then spreads the top of the handful like a fan, and draws one-half of it through the comb, the other passing by the side; with a half-turn of the wrist he then performs the same operation upon the remainder. Some ripplers, however, prefer rippling without turning the hand, by giving the flax one or two pulls through the comb; but this depends upon the quantity of the bolls. The straw, when stripped of its bolls, is carefully laid down by the rippler, placing each handful diagonally, after which it is tied up into sheaves and removed. The object of crossing the handfuls, after rippling, is that the buts or sheaves should separate easily when taken out of the steep to spread on the grass for drying. If the weather be dry, the bolls should be kept in the field, spread on the winnow-cloths, and, if turned occasionally, they will soon *win*, or dry. Passing the bolls, however, first through a coarse riddle, and afterwards through fanners, which remove the straws and leaves, will facilitate the drying process. If, on the contrary, the weather be moist, the bolls should be taken in-doors and spread out thinly and evenly on a barn-floor, or loft, and turned twice a day, leaving the windows and doors open, to allow a thorough current of air. When nearly dry, they are removed to a corn-kiln, care being taken not to raise the kiln above summer heat, where they are turned gently until no moisture remains. This slow-drying process enables the seed to imbibe all the juices that remain in the husk, and to become thoroughly ripe. If the bolls be taken direct from the field, and dried in a hurried manner on the kiln, the juices will be absorbed, the seed become shrivelled and parched, and little nutritious matter will remain in them. In fine weather, the bolls should be dried in the open air, the seed thrashed out, and the heaviest and plumpest portion of it reserved for sowing or crushing. The light seed and the chaff contain exceedingly wholesome food for cattle, and can be always profitably applied. Flax, however, ought not to remain in the field, if possible, even the second day, unless the Belgian system, which we shall shortly notice, be adopted. As soon as pulled it ought to be rippled, and then carried to the water to prevent it becoming too hard.

Watering or Steeping.

The operation of steeping requires the greatest care, as it is very critical in its results. River water is the best, and may be let in the pond the day before the flax is steeped; but if spring water is used, the pond should be filled some weeks before the flax is put in, so that the sun and air may soften the water. Water containing any mineral substance must be studiously avoided. The dimensions of the pool are from twelve to eighteen feet broad, and three and a half to four feet deep. The flax is placed in a sloping direction in the pool, the root-end downwards, and in regular rows, forming a single layer. The root of one row of sheaves should reach the tie of the next, and, when thus placed, they are covered with moss-sod, or old lea-sod, cut thin and laid close together. In new ponds, a layer of rushes, or rag-weeds, is generally placed on the flax, with the sods above it; and, where sods are not always available, a light covering of straw is used, which, when pressed with stones, keeps the flax just under the water. In this condition fermentation takes place, and, as it continues, additional weight is applied, which is removed when the fermentation ceases, to prevent the flax sinking too deep in the pool. In this state the flax is neither affected by light or air. A small stream of water, however, if allowed to run through the pool, sometimes improves the colour of the flax. The average time of steeping is from eight to fourteen days; but it varies according to the heat of the weather and the condition of the water; and great nicety is required to ascertain when the flax has received sufficient water, a few hours, more or less, being liable to injure it. The farmers, however, more frequently *under*-water than *over*-water their flax. The usual test to ascertain the condition of the flax is to try a few stalks, of average thickness, by breaking the *shove*, or woody part, in two places, about six or eight inches apart, in the middle of the stalk; the woody part is then taken out, and if it comes freely downwards, without breaking or tearing the fibre, the flax is ready to be taken out of the pool. This test is tried about every six hours after fermentation has ceased, as the change is sometimes rapid. The flax should never be lifted roughly from the pool, either with forks or grapes, but carefully handed out of the drain by men standing in the water; and it is generally an advantage to let the flax drain from twelve to twenty-four hours when taken out of the pool, the bundles being placed on their root-ends close together. Care, however, must be taken not to place the crop in heaps, or it will be injured by heating.

Spreading.

The place selected for this operation is, if at hand, a clean, short, and thick pasture-ground, with the weeds carefully mown down to the level of the sward, or removed altogether. The flax is laid evenly on the grass, in thin but equal layers; and, if care has been taken in the rippling process, the bundles will readily separate without being entangled. While on the grass, it is turned two or three times with a rod, about a foot in length and an inch and a half in diameter, to prevent it being discoloured by the unequal action of the sun upon its surface. When there is a prospect of rain, the flax is turned, in order that it may be beaten down a little, and prevented from being blown about.

Lifting.

When the flax has been upon the grass from six to twelve days, it is considered ready for lifting; and, if the weather be showery, the shorter time will be sufficient to prepare it. The general test of its being ready to lift is, to rub a few stalks from top to bottom; if the wood breaks easily, and separates from the fibre, leaving it sound, it has received a sufficient grassing. The most cer-

tain test, however, is to prove a small quantity with the hand-break, or in a flax-mill. When lifting, the lengths of the flax ought to be kept straight, and the ends even, otherwise there will be considerable loss in the rolling and scutching operations. If not scutched immediately after lifting, it is tied up in small bundles, and placed in stacks, loosely built, with stones or brambles at the bottom, which keep it dry, and allow a free circulation of air. Stacks, however, built on pillars are considered the best.

Drying.

The process of drying by fire is generally condemned, simple exposure to the sun being sufficient to prepare the flax for breaking and scutching. In some parts of Ireland, the flax is placed in a damp state to dry on kilns, and in many instances it is burned by excessive heat before it becomes dry, which impairs its rich oily property. In this state the flax is reduced in value nearly one half.

Breaking and Scutching.

There are two modes of breaking and scutching, the one by hand, and the other by the mill; if the first be adopted, the Belgian mode is the best, as it is not so wasteful as that generally practised in Ireland. If scutched at a mill, the fibre should be sent where the best machinery is in use, and where the mill-owner pays his men by the day, and not by the stone, as the scutchers are more anxious to turn out a large quantity than to produce a good yield from the straw.

(*To be continued.*)

ART EDUCATION AND SCHOOLS OF ART.

Some time ago in reviewing the rise and progress of Schools of Design in England, and endeavouring to account for their natural development into Schools of Art as at present existing, we gave a promise to our readers of making a further examination, and thus laying before them the present condition and operation of the latter. That we have not already fulfilled this promise has resulted from a conviction, then expressed and since borne out by experience, that, in reality, Schools of Art in the United Kingdom are undergoing great and fundamental changes; and, even at this present time, are in a very embryotic state of existence. What has hitherto been done in them, with reference to their constitution and management, has been necessarily experimental: what is now being accomplished is the result of experiments fairly tried in what is to us an untrodden path; and, though we think Schools of Art, and the means adopted by the State for the advancement of art-education generally, a subject of sufficient importance to interest our readers; yet we can only now refer to the subject as a problem in process of solution,—an experiment which has arrived at a certain stage of its existence,—and which, though by no means a perfectly-developed scheme, is so far matured as to offer itself as a fair subject of criticism. It will be impossible, in the narrow limits of our review, to trace the whole history of Schools of Art since their first assumption of that name, or to detail the many and various changes which have occurred in them. It must suffice if we record some of the results achieved in the ten years of their existence.

The Schools of Design were established in order to give an art education to the designer as a means of influencing those branches of manufacture which required skilled workmen to carry them on successfully. The partial success which resulted from this effort on the part of the Government seemed to indicate that a more comprehensive scheme was necessary to achieve such an end. Accordingly, in the year 1851, overtures were made by the School of Design authorities in London, to the Committee of Privy Council for Education, having as an object the introduction of elementary drawing into the national or parochial schools which were under the Committee of Council on Education. These overtures were favourably received, and it was resolved to initiate the formation of drawing classes in national schools by the gratuitous distribution of books and drawing-copies among those schoolmasters who were apparently able to use them, and manifested a willingness to do so. The head-masters of the Schools of Design were charged with the task of distributing these examples.

This, as might have been expected, was as unsuccessful as that which had already been done by the Schools of Design. The school masters were also to be allowed to study in the Schools of Design gratuitously. The Privy Council for Trade seemed persistently to shut its eyes to the fact that ordinary people value things at precisely the cost of such things, and that to present books and copies, and give the privileges of study to persons who themselves made no sacrifices or exertion to obtain such advantages, was precisely the method best adapted to cause these persons to undervalue the advantages offered. The same mistake which we noticed as having been made in the appointment of masters to Schools of Design on fixed salaries was again reenacted in this minor matter.

In 1853, on the formation of the Department of Practical Art, the system of grants to Schools of Art was entirely re organized; the errors of the previous directors of the schools were carefully avoided; a masculine and comprehensive scheme of art education was inaugurated; and the foundation was laid of a sound, business-like management, whereby the benefits of art education should be extended to all alike. We must in candour confess that, though possessing many deficiencies in detail, and though the Department has blundered in some cases, as Government offices will; yet the result of the Department's operations is convincing proof of the soundness of its system. Setting minor matters aside, the Department's career has been one long course of unexampled prosperity, which is, in a great measure, due to the masterly manner in which it is conducted.

The first subject which received the serious attention of the new Department was the cost of maintaining the nineteen Schools of Design already in existence. It was found that it would be impossible to establish new Schools of Art on the principle of subsidizing each school by a direct grant. The nineteen Schools of Design existing in 1851 cost the country £7,750, and, as one of the schemes of the Department was to establish a

School of Art in every considerable town in the United Kingdom, the somewhat novel and startling principle was enunciated, that all new schools would have to be founded on the self-supporting system, as far as this was practicable. Other alterations are so well described in the second Report of the Department of 1855, that a quotation from its pages will give the clearest idea of the new system. Speaking of the Schools of Art the late Schools of Design) receiving direct grants from the Department, the Report states that:—

"It was judged expedient that, while the local expenses should be entirely regulated by the committees, which were best able to control them, Parliamentary grants should be devoted to the proportion of instruction, either in fixed salaries paid direct to the masters, in an increase of masters, especially where necessary for public school teaching, in affording aid by means of examples, and in lectures and scholarships. It was also proposed, as an equitable arrangement, and as an inducement to exertion on the part of the masters, that a proportion of the students' fees should be in future paid to them as part of their income, their fixed salaries being at the same time reduced. Accordingly, throughout the year 1853, the grant schools were conducted under the new arrangement; and the result, as described in last year's Report, showed a marked improvement in the attendance of students, as well as in the amount of fees.

"Although the progress in the improvement of the schools was thus considerable, the establishment of the elementary local Schools of Art, which to the number of sixteen were opened in different towns in the course of the year, indicated the possibility of extending to the public increased advantages from the subsidized schools.

"Being in operation together, the new schools were found, upon comparison, to possess many advantages over the old; as they were not only conducted at less cost to the State, but also enlisted a greater amount of local interest in their success, and extended the facilities for instruction to all classes of the community, while they were founded on a system which stimulated the exertion of the masters by identifying their interest with the extension of the instruction afforded by their schools. A further re-adjustment of the grants to the Schools of Design thus became absolutely necessary. It was felt that the expenditure of £7,750 in maintaining nineteen schools would not be justified to Parliament, when sixteen schools were established and carried on, the greater part in a very satisfactory manner, at an aggregate fixed cost of only £160 per annum, and a further liability of £960 in the shape of guarantees of salaries to masters, which liability a year's experience has shown to be rarely called into operation. It was determined, therefore, no longer to ask Parliament to vote specific sums for each locality, but rather to extend the advantages afforded by Parliamentary aid wherever it might be found to be most required and appreciated.

"A circular, dated March, 1854, was issued, in which the old schools were invited to extend elementary instruction to parish schools, and to assist in the promotion of art-knowledge among the operative classes. It was pointed out to the committees that a better guarantee of efficiency, as respects the teachers, could not be afforded than by the certificates of the Department, obtained under the new system after long study and severe training; and that it was desirable to stimulate the teachers to energy and perseverance, when appointed, by the hope of augmenting their income by a commensurate increase of fees. It was also observed, that instead of the appointment of the masters remaining with the Government, and their control partly with the Government and partly with the committees, as must necessarily be the case on the plan hitherto pursued; the appointment and control of the masters ought rather to be entirely in the hands of the local committees, so as to avoid a divided authority; and it was at the same time explained that, although it was not intended to supersede the master of any subsidized school receiving a salary from the Department, the new system would be extended to all, either on the application of committees, or as favourable opportunities arising out of the retirement of the old masters might occur."

It should have been before remarked, that the Department had wholly discontinued the practice of appointing masters to Schools of Art on the mere exhibition of testimonials, and works executed by themselves. A training class for masters had been established previously to the location of the central school at Marlborough House; and the most promising of the students in it, as well as others who joined for the specific object of becoming art masters, were now required to go through a severe course of study, and present themselves for examination, at stated times, for certificates of competency to give art-instruction. It was determined to appoint no masters who could not take these certificates; and though the Department avowed itself averse to sudden or violent changes in the masterships of schools, fair warning was given to all committees that, upon new appointments, certificated masters would alone be recognized, and the new system of self-support from fees and subscriptions immediately be substituted for direct subsidy. This caused a commotion among the subsidized schools. From Manchester, Macclesfield, Sheffield, Dublin, Belfast, Cork and Limerick, urgent protests and remonstrances were received by the Department. The Cork school and Belfast school were closed: at Stourbridge and York, the masters resigned, and consternation reigned supreme amongst the masters, whilst utter dismay seized upon the committees. These manifestations, however, seem to have had very little effect on the Departmental directors. Birmingham, which came under the same regulations, instead of venting its wrath in pithily worded protests and remonstrances. founded on bad arguments and supported by infamous logic, set itself resolutely to work to try the new system; and the result was seen from the report of the head master, who informed the Department that "the influence of the school has been largely extended, and nearly three times more persons are under a systematic course of instruction in drawing at the present time than in 1851; the cost to the public fund is less, whilst the masters are better paid."

Encouraged by this example, no notice was taken of old schools in the agonies of dissolution; but where it was found practicable, as at Leeds, York, Stourbridge, and Coventry, the new system was introduced, with the acquiescence of the committees, and the teaching re-organized and most successfully carried on by the new-appointed trained masters. Manchester consented to try the experiment for a year, and has never had cause to regret its sensible resolution.

The Department resolved also no longer to pay a new master according to the size of his school, or the importance of the town in which it was placed. Instead of this, allowances were to be made according to a scale, regulated by the number of examinations the masters had passed through in London. The whole curriculum of art-education and study was divided into six groups, having a certain number of branches of art in each. For the successful passing, in both theory and practice, of each group, a master would receive an annual allowance of £10: the maximum aid to be given to each teacher was not to exceed £50. Thus a desire to excel in all branches of art-study was generated amongst the masters, when it was seen that direct pecuniary advantages accrued to them from their superior qualifications. Very business-like arguments were used by the Department in explanation of this arrangement. The advantages of it were stated as being—"That, whereas the vote of £7,550 now promotes the instruction of operatives in only twenty places, by means of less than forty masters, non-certificated, the said sum would provide at least 200 masters certificated; and that by the rules and conditions of the appointment the influence of each master would be more extensively distributed." As before remarked, the Department did not interfere with masters already in receipt of direct grants, or make them subservient to this rule, which only applied to new masters.

The most characteristic feature of the new system was the unconditional demand of the Department, that a certain number of National or poor schools should be instructed by the masters of each School of Art. The minimum number upon which a School of Art would be recognized, and the art-masters' certificates be paid, was three, which was afterwards increased to five. It was sought by this means to extend art-instruction among the mass of the people, instead of confining it as heretofore to a small class of adult artisans. It was suggested that all towns possessing a School of Art should have a minimum of one per cent. of the population under instruction in drawing.

To provide for the teaching of elementary drawing in poor schools, the art-masters were allowed to nominate advanced students of the School of Art to assistantships in it; the Department recognizing them as art-pupil teachers, and paying them £10 per annum, besides giving them the advantage of free instruction in the Schools of Art. The sum allowed to assistants was afterwards increased to £20 per annum, and thus remains. Under the direction of the head master these assistants gave to poor schools one lesson per week of one hour's duration for the sum of £5 per annum; though, in many cases, as at present, the art-master himself gave the lesson, and his assistant a second lesson, in the same week, or in alternate weeks. It was a well considered question whether the time usually devoted to drawing in these National Schools, viz., one hour per week, would be sufficient to give the pupils any practical power in drawing. The department was at some trouble to obtain opinions from a large number of art-masters on this point. These opinions were as various as the temperaments of the authors of them. Some flatly asserted that one hour per week, or for forty hours per year (reckoning vacations), was totally insufficient to give even a smattering knowledge to adults, of any subject, and ridiculously so to impart art-instruction to young children. Others, more sanguine, mantained a directly opposite opinion. The examination of children who had received a year's instruction of one hour per week speedily set at rest the vexed question. By means of exercises in the subjects of free-hand drawing, geometry, perspective, and model drawing, worked in the space of forty minutes for each subject, it was found that a very valuable power of drawing had been acquired. The accurate imitation of a form in outline cleanly executed from a copy; the power of remembering, solving, and working out as many as six geometrical problems selected from a text-book containing sixty or seventy problems; the representation in outline of a geometric model drawn freehand from the model itself; and the working out of simple perspective exercises,—all these were found to be executed with facility by children of from ten to fourteen years of age, who had received a year's instruction of forty hours. A method of teaching drawing in these subjects, by means of copies drawn by the teacher on the black board, enabled large classes to be taught simultaneously,—accurate proportions, carefully pointed out to the children,—simple constructional lines used in drawing symmetrical objects, familiar subjects being chosen as examples, through explanation of the terms used in geometrical figures, with test of the accuracy of the problems given, these being attended to by the teachers,—were found to give great interest to the drawing lesson. More than one case has come to our knowledge where a school which has been irregularly attended during the week has been crowded on the occasion of the drawing lesson,—a gratifying testimony to the interest awakened by the new lesson.

Among other reforms introduced by the Department, the re-adjustment of the conditions on which grants of copies for teaching drawing in parochial schools and Schools of Art are given deserves to be mentioned. Instead of presenting such copies gratuitously to poor schools, all schools were required to pay a proportion towards the cost of such examples. Thus Schools of Art and parochial and national schools obtained books, examples, and casts, through the appointed agents, paying the usual price for them, upon which the Department and the agent together allowed a discount of nearly fifty per cent., whilst private middle class schools received a discount of fifteen per cent.; and this arrangement is still in operation with admirable effect. The only drawback to the arrangement is the existence of only one agency in London for the supply of examples, and the consequent prevention of requisitions being made for small supplies of examples, on account of the great delay arising in complying with the demands, and the proportionate important cost of carriage for small parcels. We have no hesitation in predicting the doubling or trebling of the demand for these copies if the Department would make arrangements for the supply of them through local agents in all large towns where a School of Art exists. This would dispense with the cost of carriage and the terrible delay of passing the

copies through the London agent alone No difficulties seem to have been experienced in inducing Messrs. Chapman & Hall to undertake the agency for casts and examples in London ; and we see no reason why respectable publishing or bookselling firms in provincial towns should not be appointed as local agents. Whether appointed by the Department, or by Messrs. Chapman & Hall, is a matter of no moment; for in either case the increased facilities of obtaining the examples would materially extend the demand for them. This is a point we earnestly recommend to the serious attention of the Department's officers, and feel assured it will repay any amount of trouble taken in bringing the suggestion into operation.

The completion of our review, and touching one or two points in the management with which we may be less contented, must form another article.—*Mechanics' Magazine.*

PROGRESS OF THE INTERNATIONAL EXHIBITION.

Notwithstanding the number of days in the last week on which no work was done, partly on account of the national mourning, and partly in consequence of the Christmas holidays, the progress made is very apparent, and may be pronounced to be highly satisfactory. So far has the building now advanced, that it is beginning to assume an air of completeness, which promises well for the easy fulfilment of the contract within the appointed time.

The eastern dome is no longer a cause of anxiety ; all the ribs are in their places ; three of them are entirely finished, and the others only want the top jointings ; in a short period it may be expected to be ready for the glaziers. All the wood-work of the lower portion is fixed, and only waits to be boarded to be protected from the weather. The brickwork of the great arch over the entrance, which has a span of about 80 feet, is completed.

It may be seen that the dome scaffold at the western end of the nave has a somewhat different appearance to its fellow before the raising of the ribs. This is owing to the arrangements which have been made to fix the ribs, which are different from those on the opposite scaffold, and promise an easier and more speedy accomplishment of that object. The brick arch over the western end is also finished, and the arrangements for fixing the ribs being completed, the task itself will soon commence.

The flooring has been carried over the whole of the south-eastern and south central courts ; this portion of the work proceeds with a rapidity which is truly marvellous. Visitors can now walk on dry plank flooring over the whole of the southern courts, as well as the long corridors underneath the picture galleries. The offices underneath the smaller or water-colour galleries are also fast approaching completion, so that the staff of her Majesty's Commissioners will soon be enabled to transact business in the building itself when it may be determined to be more convenient to do so.

The brickwork of the refreshment courts has been executed in cement, and will not be affected by the frost. It is nearly finished. The joiners and carpenters works are also in a forward state, and there seems no reason why the structural portions should not be completed with the rest of the building, although such a condition does not form part of the contract of Messrs. Kelk and Lucas. The plastering and decorations will take some longer time. A suggestion has been made that Messrs. Minton should floor the part which forms the entrance to the horticultural gardens with tiles, for the making of which they have obtained so deservedly high and wide-spread a reputation.

Some experiments have been commenced in the nave for colouring the interior, and are still in progress. They are under the direction of Mr. Octavius Hudson, who has obtained so much credit for his works in Salisbury, Ely and Chester Cathedrals, and who is known for his great learning on coloured decoration. It is obvious that as there are large surfaces in the present building which did not exist in the building of 1851, a very different system of colouring will be required, as great quantities of the primitve colours, suitable enough for thin lines, would be inappropriate here.

The acceptances of space are being fast returned from British exhibitors ; no less than 2,500 have been received since Saturday last. It is expected that the total number will reach 8,000.

The method adopted for the production of the Illustrated Catalogue appears to be received with favour ; many pages have already been taken by exhibitors for the more detailed descriptions and illustrations of their goods.

The Imperial Commission at Paris has issued its 24th bulletin by which it appears that the detailed plans for the arrangement of space are completed. Exhibitors are requested to act, as far as possible, in concert, in order to render the whole exhibition as harmonious and effective as possible. Many of the French exhibitors, after complaining of the smallness of the space allotted to them, and after obtaining twice that allotment, now state that they will be unable to fill even the space originally placed at their disposal. Such a course of conduct threatens to disarrange entirely the plans of the Imperial Commission, who may be put to great inconvenience to induce fresh exhibitors to come forward and fill the vacant spaces. French goods are to be delivered at the railway stations by the 10th of March under the penalty of having the space destined for them transferred to others.—*Journal of the Society of Arts.*

THE LIME LIGHT AT THE SOUTH FORELAND.

Five-and-thirty years ago Lieutenant Drummond brought into notice the oxyhydrogen light, and applied it to a practical purpose. Having been appointed to conduct the Ordnance survey in Scotland and Ireland, he used this light in focus of a parabolic reflector on lofty eminences, where the stations were usually placed, as it was of the greatest importance in those operations to have certain and determinate signals, which could be seen, under any circumstances as to weather, at great distances. Thus he succeeded in connecting the shores in England and Ireland, near Holyhead, a distance of 65 miles, and afterwards, in Scotland, the summit of Ben Lomond with that of Knock Layd, no less than 95 miles apart. It did not escape the comprehensive mind of Drummond to perceive that such a light, if capable of

practical application, would be invaluable for lighthouse purposes. With the means he devised however, he failed to obtain anything approaching practical command over the continuity of the light; and as a light that is liable to go out is inadmissible for lighthouse purposes, it is not surprising that it was condemned

Since Drummond's time, until quite recently, the oxyhydrogen, or lime light, has been used only for the purposes of the microscope, or to produce scenic effects; not that the value of a light of such power and intensity has been lost sight of, but because all attempts to render it practically available in a commercial sense had failed.

The impossibility of turning it to a useful purpose seems to have so taken possession of the public mind, scientific as well as general, that although within the last two or three years, exhibition after exhibition, varying in duration from hours to months, have given the most incontestable proofs that with Bartable's apparatus the lime light can be burned as easily and certainly as a wax candle, yet, with a single but notable exception, not one eminent man of science has been found who has not scouted the idea of its practical utility. Upon almost every occasion of late when our men of science have condescended to mention the lime light, it has been condemned by them as impracticable, and the idea of its applicability to any useful purposes contemptuously dismissed; whilst the assumption that it can be used for ordinary domestic purposes has met with most positive contradiction, interspersed, upon one or two occasions, with assertions as to the available sources and expense of oxygen gas, which, although valueless in themselves, are useful as indicating the amount and accuracy of information upon the subject possessed by some of those who have pronounced the severest condemnations of it. It has been the fashion in scientific circles to condemn the lime light, and there are few amongst those who have not compromised themselves more or less by decrying it; and experience will have taught us that from such we can expect but a tardy recognition of even a fact that is subversive of a long cherished dogma. This prejudice, which has seriously impeded the general introduction of the lime light, is traceable to its usual source—want of accurate information on the subject; for although the means were at hand, not one of those who ridiculed the idea that the lime light had been brought to a state of perfection, rendering its practical application to illuminating purposes easy and certain, took any trouble to make such an investigation as to the alleged fact as could justify the expression of any opinion at all. The public at large took the view of the *savans*, whose opinions were readily adopted and disseminated by those who are interested in the continuance of the present methods of producing artificial light; whilst the verdict of gas engineers, scientific advisers to Gas Companies, and other vested interests, upon the lime light was such as a notorious poacher might expect at the hands of a jury composed of cock-pheasants.

In the mean time, however, whilst the learned condemn it, and capital fought shy of it, the light went on burning steadily—carefully watched, examined, and, in course of time, appreciated by one, at whose hands truth never suffers, imposture is never spared, and whose opinions are ever formed for himself by patient and careful investigation, and not expressed until all doubt has been removed. Without having been made aware of the exact conclusions arrived at by this investigation, it must be supposed to have been favourable, as it led to a decision on the part of the Trinity Board to give the light a fair trial in a first order lighthouse, for which its peculiar qualities are preëminently fitted. To this end a contract was entered into with the Universal Lime Light Company by the Elder Brethern for the exhibition of the light in the South Foreland Lighthouse for three months, and upon its success will in all probability, depend its extensive adoption for the purposes of coast lighting The light was introduced on the 26th of August, and has continued to burn steadily and brilliantly every night since its substitution for the oil light. Indeed, after the report of Mr. Page, the engineer of Westminster bridge, upon the success of the lime light which for two months illuminated the finished part of that structure, no doubt can exist as to the facility with which it can be maintained for no case of failure occurred there in maintaining regularly eighteen lights in nine different lamps where the operation of making the gases had to be conducted upon temporary platforms, suspended between wind and water, and the whole arrangements necessarily of an incomplete and temporary character, added very largely to the ordinary risk of a failure occurring. The lamp at the South Foreland is fitted with eight burners, to meet the requirements of the Fresnel apparatus, which is composed of eight panels: only six out of the eight burners, however, are required, as the two panels towards the land are darkened. The manipulation of the lamp is perfectly simple, not necessitating an amount of intelligence greater than is required in the case of an ordinary Argand lamp. When the time for lighting comes the lime wicks are inserted, the clock which moves them wound up, and the gases turned on, and no further attention is required until the hour arrives for putting out the light, when the gases are turned off, and the clock is stopped; the lime wicks are then removed, and nothing further remains to be done. The brilliancy of the light has not escaped the notice of our friends on the other side of the Channel, many of whom have been over to visit it. It is but fair to state that the present apparatus in which the lamp is exhibited is not calculated to give the maximum effect, having been especially adjusted for the usual Argand oil lamp, which differs from the lime light in the essential particular of focal distance, which is measured from the centre of the former, but from the surface of the latter; the lime light, therefore, although of the same diameter as the oil flame, is too near the lenses by half its diameter—in this case by 1⅞ inches. It is to be hoped that this light will be tried both in a French apparatus, specially adjusted, and in the focus of a paraboloid, for it appears to possess every element, rendering it by far the best light for coast purposes ever introduced.

Amongst other attributes of the lime light is another of the very last importance. It is not effected by wind, even though unprotected by glass. At Liverpool, where the lime light was exhibited for

two months upon the landing stage where the Birkenhead ferry boats ply, this property was most severely tested. One night a gale of wind came on, and increased in violence uutil the glasses of the lanterns were dashed in, and the light was exposed to its full power. No apparent effect was produced upon them, for they continued to burn as steadily and brightly as before. It has happened not so unfrequently as might be imagined, that the glass of our lighthouses has been broken, in violent gales, and the light blown out.

THE RUSSIAN PACIFIC TELEGRAPH.

The plan for establishing a telegraph line connecting Europe through Siberia with the Pacific Ocean has, during four years, had time to take shape and form, so that, at the commencement of the present year, the supreme sanction was given to the project for constructing a telegraphic line in the counties bordering on the Amoor and Oussouri, from Nikolaiewsk by Kabarovka to the port of Novgorod, (1,900 versts,) the most important point of the possessions recently annexed to Russia on the sea of Japan. The establishment of this line is undertaken by the Ministry of Marine, at its cost and under its direction; and at the same time the superior direction of the means of communication (Board of Works) has commenced the construction of a line starting from Kasan in the direction of Siberia, which proposes opening at the end of the present year a telegraphic communication from Kasan to Omsk, (1,900 versts) and continue it afterwards to Irkutsk, a distance of 2,475 versts from Omsk. Thus, probably within two or three years, on the one side there will be telegraphic communication between Europe and Asia to Irkutsk, and, on the other hand, our new colonies on the Amoor and Oussouri will be connected with each other, and with our principal ports on the Japanese waters. Thus of the extent of 10,000 versts, which the Siberian telegraph will embrace, there only remains the central portion, that of Irkutsk by Kyachta to Kabarovka, about 3,500 versts, where as yet nothing had been settled; but it is beyond a doubt that as soon as the works actually projected shall have been successfully completed, this intermediate line will be constructed, and thus, within four or five years at the latest, the gigantic project of a telegraph from Europe to the distant lands on the shores of the Pacific Ocean will be realized. The year 1861 promises to be a memorable one, if we consider the great questions which will receive a solution. Among those questions we must place the commencement of a durable connection and the establishment of rapid communication between Siberia and civilized Europe, and the apparatus of the electric telegraph on the virgin shores of the Amoor and Sea of Japan. It seems needless to point out the importance and usefulness of so vast an extension of improved communication by the promoters of civilization and commerce.—*St. Petersburgh Gazette.*

Colonel Romanoff, of the imperial Russian engineers, was introduced to the members of the New York Chamber of Commerce, October 11th, to lay before them the project of a telegraphic line to run from St. Petersburgh to some point on the eastern shore of Siberia, and from thence to the Russian possessions on this continent.

The great overland telegraph to be erected, will, when completed, form a direct chain of communication throughout the world. It was first started in accordance with an ukase from the Emperor of Russia, issued in 1858, since which time three thousand miles of it have been laid from St. Petersburgh to Omsk, in Eastern Siberia. Moscow, three thousand five hundred miles from that point, will be the principal station. The wires will go over Behring's Straits, a distance of forty miles, the currents of which depend on the winds, and are never beyond three miles. The widest gap in the Straits is eight miles. The line will cross from Omsk to Orkutsk, thence to Kyachta— the great *entrepôt* of commerce from Siberia to China; from that point it will be continued to the Altai Mountains to Cheta, and thence to Nicoleisk, at the mouth of the Amoor River. This will end the Russian project which has been guaranteed by the government. The propriety of continuing the line to the United States is now under advisement, and the project is considered easily practicable, involving only an additional outlay of $1,000,000 or $3,000,000, according to the route taken, The following table shows the number of miles to be embraced by the whole line:

	Miles.
St. Louis to San Francisco, (1,800 miles finished,)	2,000
San Francisco to Prince of Wales' Cape, ...	2,500
Behring's Straits (submerged,)	40
East Cape to mouth of Amoor River, ...	2,400
Amoor River to Moscow, (1,200 miles finished,)	7,000
Total...	13,940

Count Romanoff states that the line will be completed to Irkutsk in about a year, which will enable the merchants of London to communicate with Pekin in fourteen days. It has been proposed to extend it from the mouth of the Amoor to Jeddo, Japan, which will involve but three submerges— one of six miles, one of eight and another of twelve. Count Romanoff also stated that the cable sunk in the Red Sea by the British government, to communicate with India, was eaten by insects, with which the water abounds, after it had successfully operated for about three months, and it is now considered impracticable to renew the enterprise at that point. The British government had appointed a commission to inquire into the causes of the failure.

American vessels frequently sail to the Amoor with spices, tea, coffee, iron, &c., and the establishment of telegraphic communication between the United States and that point, and Russia in general, must tend to increase the trade between both countries.

Col. Romanoff will prosecute his inquries in the United States for about two months, and then return to Russia. Mr. Collins, in the mean time, will give him many of the facilities necessary to his mission.

The proposed line will unite all the telegraphs in the world, without crossing the Atlantic Ocean, so that the great "cable" enterprise need not be resuscitated. The cost is set down for two wires at $3,000,000. To maintain this line, one thousand men, at $300 each per annum, would become

necessary, making a total of $300,000. To this force it is proposed to add one hundred stations, at $1,000 per annum; two supply vessels at $40,000; interest on capital at 7½ per cent. per annum, $210,000; contingencies, $100,000. Total, $750,000. It is calculated that 300,000 messages, at $5 each, would be received, making a total of $1,500,000 revenue.

THE DELETERIOUS EFFECT OF LIGHT ON POTATOES.

The influence of light on vegetation is now regarded as a matter of the utmost importance, and although the precise mode of action may not be always understood, yet powerful effects of it are everywhere perceptible. In its absence leaves become blanched that would otherwise be green. Roots that are white underground become green when exposed. Turnips, white beneath, are green or perhaps red above, and many kinds of fruit, naturally pale, color under bright sunlight. By the action of light on leaves, the different secretions peculiar to plants are formed, such as gum, sugar, starch, oils, and even, in certain kinds of plants, deadly poisons. In some plants, too, the secretions due to the action of light are in certain portions harmless and nutritious, whilst in other parts of the same plant, through the same agency, highly deleterious principles are formed. The potato offers an example. Everybody knows that its tubers contain wholesome food, and it is also generally known that the stems, and especially the apples or seed vessels, are deleterious. But the treatment to which the potato is sometimes subjected is calculated to develope the poisonous quality in the tubes themselves, a change which can only take place during exposure to light. The poison found in the green parts of potatoes is called "solanine." This exists in several species of Solanum, and is found in considerable quantity in the shoots of potatoes. To obtain it the shoots are bruised and acted on by water acidulated with sulphuric acid. It is very poisonous. (Turner's "Elements of Chemistry.") Liebig says it is a powerful poison.

Although the stems of potatoes, according to the authorities just quoted, contain in notable quantity the noxious and easily-extracted principle, so dangerous in its concentrated form, yet the tubers grown underground and kept in the dark are floury and white when cooked, if the variety of potato is good, and quite free from acrid taste, which is one of the characteristics of solanine, and a sure indication of its presence. But the potato tuber is in reality a sort of stem; for it is furnished with buds, which, under favourable circumstances, push into shoots, as buds do on stems above ground. It is therefore, highly susceptible of the influence of light; for although both its skin and flesh are white, they soon become green by exposure; and the continued presence of light renders them as green as stems above ground. It is said that pigs have been killed by giving them potatoes greened to this extent. Such, of course could not be sold for human food. For this purpose potatoes exposed to light must be housed or otherwise shaded before the green tinge is apparent, at least to the naked eye. But under the impression that the tubers keep better after having well basked in the sun, many cultivators are in the habit of turning them up, and spreading them out on the surface of the ground in bright sunny weather. This has the effect of greatly deteriorating their quality. Notwithstanding disease, really good potatoes can be found; but even slightly diseased ones, with the infected portions cut away, are infinitely better than quantities of others which, though they have a goodly appearance, have been greened. Instead of being white and floury when cooked, they are yellow, and have a disagreeable acrid taste, which can scarcely be disguised, or, if it should, there is no proof that the deleterious effects of the acrid principle are counteracted. At all events, it would certainly be very desirable that such means should be adopted as would prevent that principle being generated, or in other words, the tubers should be kept as much as possible in the dark instead of exposing them to light. The advantage of exposure as regards better keeping is doubtful, whereas the deterioration it occasions in the quality of the tubers as an article of food is certain. I have thus endeavoured to draw attention to the subject, and it is the duty of every one who is aware of the deleterious effects of light on the potato to explain it to those who are not; for a knowledge of it, if acted upon, would prove beneficial to both rich and poor.—*The Gardener's Chronicle and Agricultural Gazette.*

THE GOLD MINES OF NOVA SCOTIA.

A paper was lately read on the above subject by Principal J. W. Dawson, of McGill College, before the Natural History Society of Montreal. He says, "There is little room to doubt that gold will be found throughout the entire coast metamorphic district of Nova Scotia. Careful examination may show that the gold occurs chiefly or entirely in the veins traversing certain bands of the thick beds of slate and quartz rock in these districts; and these may be recognized by their mineral character, especially if defined in their relation to the other beds by a detailed survey of the productive localities."

In the last number of *Silliman's Journal* there is an article on this subject by O. C. Marsh, A.B., of the Scientific School, Yale College. He states that there is a belt of metamorphic rocks extending the whole length of the province of Nova Scotia, varying in width from ten to fifty miles, and that it is composed mainly of clay slate and quartzite, replaced by mica slate, gneiss and granite in some sections. This coast range, according to Prof. Dawson, probably belongs to the old silurian. Mr. Marsh has visited the Tangier mines, situated sixty-seven miles east of Halifax. The strata which contain the gold consist of clay slate, traversed with compact veins of quartz.

The strata is much disturbed, and an examination for fossils was unsuccessful, the igneous action so evident in this region had probably obliterated all traces of such. Perfect fossils, however, have lately been discovered near St. John, New Brunswick, in clay slate. The gold at Tangier occurs mainly in the quartz veins, which are about one foot in width. Gold, in no small quantity, has also been found in the soil and in the bed of a small stream near the mines.

Among the specimens of gold obtained, Mr. Marsh noticed three isolated crystals which resembled in general appearance those brought from California. The mines at Tangier are on government lands; a claim of 30 by 33 feet is rented at $20 per annum, and during last August 700 men were working on the claims, and a large amount of gold had been taken, but at least one-third was lost by the rude mechanism used for its extraction. One apparatus used consisted of two large granite boulders attached by short ropes to a horizontal beam on either side of an upright shaft, and two horses dragged them round about, as in the old horse gin. The quartz was put on a paved floor, and kept wet, and was crushed by the two boulders as they were dragged over it.

At Lunenburgh, about seventy miles west of Halifax, and about one hundred and thirty from Tangier, the gold also occurs in quartz veins, traversing the clay slate. This locality has yielded large quantities of gold with very little labor. These mines are upon the sea shore. Mispickel is abundant, and its presence makes gold washing among sand very troublesome. "While at Lunenburg," says Mr. Marsh, "I was informed of a circumstance connected with the discovery of gold, which illustrates the utility of even a little scientific knowledge, and the need of its more general diffusion. Some years since, a farmer living in the neighborhood of Chester, thought he had discovered a valuable copper mine on his land, and at great expense he sunk a shaft about 80 feet in depth. Finding little copper to repay his labor, and having exhausted all his means, the work was finally abandoned. In his exertions he had cut through a large quartz vein richly stored with gold, which he had noticed, but supposed it was merely copper pyrites. The present owner works this copper mine for gold."

The Tangier gold of 18.95 specific gravity, as analyzed by Mr. Marsh, contains, gold, 98,13 parts; silver, 1.76; copper, .05; iron, a trace. The Lunenburg gold is very similar in composition. The metamorphic strata of Nova Scotia are similar to the gold-bearing rocks of other countries, and are of vast extent. The extraction of the gold at these mines by quicksilver had not been commenced hence all the finest gold was lost in the washing. The total amount of gold hitherto obtained has not been ascertained.—*Scientific American.*

INKS.

Black Permanent Ink.—Nitrate of silver 2 parts; distilled water 28 parts; sap green 1 part. Dissolve.

For the Mordant.—Common soda 2 parts; gum arabic 1 part; soft water 8 parts. Mix, and moisten the linen with this fluid, and well dry before using the ink.

Yellow Ink.—1. French berries 1 pound; alum 2 ounces; water 1 gallon. Boil and strain, then add gumarabic 4 ounces.

2. Water 30 parts; Avignon berries 7 parts; gum and alum each 5 parts. Boil for one hour, and strain.

Blue Ink for Ruling.—Take 4 ounces of vitrol, best quality, to 1 ounce of Indigo; pulverize the indigo very fine; put the indigo on the vitrol, let them stand exposed to the air for six days, or until dissolved; then fill the pot with chalk, and add half a gill of fresh gall, boiling it before use.

Black Ink for Ruling.—Take good black ink, and add gall as for blue; do not cork it, as it will pre vent it from turning black.

Red Ink for Ruling.—One pound of Brazil wood to one gallon of the best vinegar; let the vinegar simmer before you add the wood, then let them simmer together for half an hour, then add three quarters of a pound of alum to set the color; strain it through a woolen or cotton cloth, cork it tight in a stone or glass bottle. For ruling, add half a gill of fresh gall to 1 quart of red ink, then cork it up in a bottle for use.

Indian Ink.—1. Take finest lamp-black, and make it into a thick paste with thin isinglass; size, then mould it; attach the gold leaf, and scent with a little essence of musk.

Carbon Ink.—Dissolve real India Ink in common black ink; or add a small quantity of lamp-black, previously heated to redness, and ground perfectly smooth with a small portion of the ink.

Gold and Silver Ink.—Fine bronze powder, or gold or silver leaf, ground with a little sulphate of potash, and washed from the salt, is mixed with water and a sufficient quantity of gum.

Gluten Ink.—Dissolve wheaten gluten, free from starch, in weak acetic acid of the strength of common vinegar; mix 10 gr. of lamp-black and 2 gr. of indigo with 5 oz. of the solution, and a drop or two of oil of cloves.

Ink for writing on Zinc Labels—Horticultural Ink.—1. Dissolve 100 gr. of chloride of platina in a pint of water. A little mucilage and lamp-black may be added.

2. Sal-ammoniac 1½ dr., verdigris 1 dr., lamp-black 1 dr., water 10 dr. Mix.

Chrome Ink.—Extract of logwood ½ oz; gum ¼ oz; water a pint. Dissolve also in 12 oz. of water ½ oz. of yellow chromate of potash (or ¼ oz. each of bichromate of potash). Mix the two solutions. The ink is ready for immediate use.

Ink for writing on Steel, Tin Plate, or Sheet Zinc.—Mix 1 ounce of powdered sulphate of copper and ½ ounce of powdered sal-ammoniac, with 2 ounces of diluted acetic acid; adding lamp-black or vermillion.

Indelible Ink for Marking Linen.—1. The juice of sloes 1 pint; gum ½ ounce. This requires no mordant, and is very durable.

2. Nitrate of silver 1 part; water 6 parts: gum 1 part. Dissolve. If too thick dilute with warm soft water.

Autographic Ink for Lithographers.—White soap 25 parts; white wax 25 parts; mutton suet 6 parts; lamp-black 6 parts; shell-lac 10 parts; mastic 10 parts. Mix with heat, and proceed as for lithographic ink.

To restore writing effaced with Chlorine.—1. Expose it to the vapour of sulphuret of ammonia, or dip it into a solution of the sulphuret.

2. Ferrocyanide of potass 5 parts; water 85 parts Dissolve, and immerse the paper in the fluid, then slightly acidulate the solution with sulphuric acid.

Miscellaneous.

British Newspapers.

There are 210 newspapers of all descriptions, published in London and the metropolitan districts. of these twenty are published daily; five of them being devoted exclusively to commercial and shipping affairs. Of the religious class, nine are conservative, advocating the opinions of the Church of England; seven are liberals, and advocate the various opinions of dissenters; and four defend the Roman Catholic creed. Seventeen journals are exclusively dedicated to various branches of commerce; nine papers attend to the concerns of railways, engineering, mining, and building. Agriculture is attended to by eight papers: and the turf, the prize ring, and what the French term *Le Sport*, by seven. Law supports four journals, and medicine the same number. Rifle volunteers and military subjects in general, are attended to by six. Musical matters and the theatre each occupy two journals. Three weekly papers criticise new books. The Pawnbrokers and the police have each one journal; court and fashionable matters have two.

In the thirty-nine counties of England (excluding Middlesex) there are about 580 journals, published at various prices, ranging from 1d. to 5d., nearly one-half the number being sold at 1d.; 230 of these support liberal political and religious views; 110 are conservative, or liberal conservative: 47 call themselves independent, and 193 are avowedly neutral.

The increase in the number of newspapers within the last twenty years may be counted by hundreds, and the circulation by hundreds of thousands. One of the penny dailies has a circulation of seventy thousand, and one of the cheap weekly more than three times as many. The political influence of a newspaper is not always in proportion to its circulation. The *Times* does not circulate sixty thousand copies daily, yet its influence, both on government and throughout the country, is incomparably greater than that of any other journal.

Wales publishes 32 papers; 28 printed in English, 4 in Welsh; of these, one third is liberal, another third neutral, and the remainder various shades.

Scotland publishes 160 papers; of which 90 are liberal, 17 conservative, 14 independent, and the remainder style themselves neutral.

Ireland numbers 138 newspapers; of which 38 are liberal and 38 conservative, 11 independent, and the remainder neutral.

There are 32 papers published in the Isle of Man, and the Channel Islands.

The brief summary is 1,142 in number; of which 464 are liberal papers, 190 conservative and liberal conservative, 83 independent, and the remainder neutral.—*Scientific American.*

Important Telegraph Discovery.

An English paper makes public the discovery of a "telegraphic cable" and a mode of working it, that renders distance and the media through which such cable is laid, an auxilliary instead of an obstruction, obtaining supplies of power from a hitherto unsuspected source. The invention is the product of William P. Piggott, of London, an eminent medical electrician. The peculiarity of the cable is that instead of requiring an enormous electrical charge to be forced through the whole length of a line by powerful batteries, at each successive transmission of a signal, as at present, in long sea and land routes, the wire continues statically charged as it is laid, whilst the least disturbance of the equilibrium of this passive electric charge—inoperatve and uninfluenced until called into action by the operator—answers through all its length to the slightest transmitted influence, and so serves every practical purpose. The enormous tension that electric cables now undergo, arising from the great power of the electric current required for long distances, and which is believed to have caused the failure of all marine cables more than three hundred and fifty miles long hitherto laid, is thus obviated. The earth currents, which have previously been great obstacles, are absorbed and utilized. The cable depends for its supplies, either on the voltaic current created by bringing together wires of different electric property in its construction, or by self-acting generators placed at any desired distances throughout its length, as so many relays of power absorbing from the moisture of surrounding media, whether air, or earth, or sea, enough electricity to become statically charged; and so, at the slightest impulse, is capable of conveying communication to any conceivable distance. The invention is in the hands of the British government. Not its least merit is the probability that it will reduce the cost of telegraphic communication to a fifth of the present rates.

Manufactures from Human Hair.

In the Zoology section of the British Association Mr. Danson offered a few observations on the manufacture of human hair as an article of consumption and general use. He submitted for inspection specimens of articles manufactured from human hair, and which appeared to be of a very massive and heavy character. The paper ran thus: Truth goes further than fiction; therefore I can say my sister conceived the idea, and caused the collection of about 3,500 pounds of human hair, in a few months in Liverpool, by one female, who was merely assisted by her husband and son in carrying it out, received £1 to £2 per week.—We had two shawls made from it—cotton warp, (exhibited to the section) It is extremely warm and durable clothing; and with care and attention any quantity of the stuff can be obtained, It would appear fabulous to say that 100.000 or 200.000 bales might be obtained perhaps 500,000 or 1,000, 000, could be obtained, even within twenty-one years, that is, annually, and of all sorts, both long and short, and of all which is at present wasted and not enumerated in the articles of commerce or of general consumption. I am authorised to state that this has been in the possession of Messrs. R. W. Ronald and Son, of Liverpool, for some years, who will forward 100lb weight to any consumer on receipt of a post-office order for £2 15s. (The items making up this sum, commission, &c., were enumerated.) The article is as collected; and heavy foreign sheep's wool, in dirt and grease,

being 6d. to 14d. per lb., shows its cheapness for consumption generally. The Manchester goods are exchanged in Germany for long hair, which is sold in London. There are 3,500lbs. in seven bales, and insured in the Manchester Fire Office for £200; so any one can test their existence by policy 180, 631. The manufactured goods can be shown at the Great Exhibition in 1862! and if it were collected in factories the value would be quarterly-divided, and added to the saving's bank deposit. At the conclusion Mr. Danson suggested that specimens of these works should be placed in every museum in the kingdom, and trusted that the Smithsonian Institution would give the question their ablest support. Dr. Lankester observed that he thought the adoption of that manufacture would be a source of profitable industry. The girls in Germany and France looked forward every year regularly for pocket money by the sale of their hair, considering it as a harvest. The French girls, with their dark hair, usually got from 30s. to 40s., whilst the lighter hair of the Germans realised less. Mr. Danson said the human hair was capable of being made into the finest fabrics for ladies' wear.

British Railway Statistics.

Returns just issued cover two years—1859 and 1860—and show the annual traffic of all kinds, and the annual working expenditure, in the bulk and in detail. There were at the end of 1860, 10,433 miles of railway in use, or 431 miles more than in the previous year. The total passenger traffic over these lines was 163,435,678, or 13,678,384 more than in 1859.

The total returns from all sources of traffic in 1859 was £25,743 502, and in 1860 this was increased to £27,766,662. If we turn to the table showing the working expenditure, we find some striking figures. The actual cost of working 10,433 miles of railway in the United Kingdom is £13,-189,368. In this item are included £2,437,362 for maintenance of way; £3,801,282 for locomotive power; £3,699,708 for traffic charges, (coaching and merchandise;) and no less than £181,170 for "compensation," a charge alone of 1.37 per cent. The great items of expense are thus:—maintenance of way, locomotive power and traffic charges; but repairs and renewals of carriages and waggons swallow up the £1,118,784, and there is a comprehensive item for our old acquaintance, "sundries." Thus it comes about that the proportion per cent. of expenditure to the total revenue is, in England, 48, in Scotland, 44, in Ireland, 45, per cent. Scotland, therefore, seems to have the most cheaply managed lines, and Ireland where railways pay no government duty, exceeds by one per cent the Scottish cost of management. These enormous figures explain the comparatively low dividends of railway companies; for the £14,561,118 available for division has to be distributed among the shareholders who have contributed the £330,000,000 of capital sunk in our railways.

A Canadian Flax Mill.

The Paris *Star* contains an account of a visit to the flax mill of Mr. J. Brown, situated in Warsaw, township of Bleinheim, near the Richwood Station of the Buffalo and Lake Huron Railroad. The *Star* says: Mr. Brown has cultivated 180 acres of flax this year, and two hundred and twenty acres more; so that when the season's operation are complete, he will have prepared for market the product of four hundred acres. The Wolverton Mill is in charge of Mr. William Armour. The flax-straw comes to the mill in small bundles or sheaves, denuded of the seed, and with the pith so much decomposed as to be easily separated from the fibre. In this state it looks very much like hay tied up in small bunches. The first process through which it is put is one designed to break the pith into fragments. This is done by passing the straw repeatedly through heavy-fluted iron rollers. When the pith is sufficiently broken, the straw is taken to another machine, consisting of a series of knives about two feet long, made to revolve rapidly, each knife striking the straw as it passes and pulling out the pith from the fibre. This has to be done repeatedly, handful by handful till the whole is reduced to a bunch of soft silky fibres. In the last mentioned process a quantity of short fibre is pulled out with the refuse pith, this is tow and is used in the manufacture of coarse cloth.—*Essex Journal*, December 14th, 1861.

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood-cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURES AND MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of LOCAL INDUSTRY, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

FEBRUARY, 1862.

A STANDARD HORSE POWER FOR STEAM ENGINES.

It is customary to value steam engines by the conventional unit of horse power. A manufacturer will build an engine of so many horse power for so much money, but if you ask for the dimensions you will hardly find two makers who will give the same figures. In Britain the manufacturers have approximated to a common standard, but in Canada and the States, "*nominal horse power*," as a commercial unit of capacity, or power of performance is an exceedingly vague expression ; so much so that scarcely an individual manufacturer can be found whose practice is uniform. It signifies but little what a horse power is defined to be, so long as it is uniform, but at present the same sort of confusion exists as would be introduced if every mechanic were to adopt a different length for his foot rule, one making it twelve inches, another thirteen, and so on.

A recognized uniform standard of power is a desideratum which, if established, would enable buyer and seller to deal with greater confidence and certainty, and is, therefore, a legitimate subject for legislation.

For an article which is every year becoming more essential as an adjunct to the most important industrial pursuits, there should certainly be a common unit of measure. If we bargain for a bushel of wheat, a barrel of flour, a yard of calico, or a ship of so many tons burden, a legal standard determines with the utmost nicety the quantity we are to receive; but if we contract for a ten-horse steam engine there is room for a hundred different interpretations as to the actual size und practical value of the article. This uncertainty is the fruitful cause of dissatisfaction and not unfrequently of litigation. We were recently called upon to give evidence in a case where the dispute hinged on the capacity or actual force to be understood by so many horse power. A dozen witnesses, all of them professing to be experts, were examined, but no two of them held the same opinion, further than that a horse power should indicate the ability to elevate 33,000 lbs. one foot high in one minute. Beyond this not very convenient constant, laid down by Watt in the very infancy of the steam engine, no one appeared to have advanced. As to how the power thus demanded was to be developed there was no fixed opinion. Whether in a small cylinder with high speed and high pressure, or in a larger cylinder under opposite conditions, was apparently as unsettled as in the days of the Marquis of Worcester; nor was there any greater concord as to the size of cylinder and pressure of steam which would best produce the required force.

This uncertainty must tell materially against the extension of the use of steam power by prejudicing the interests of both manufacturer and purchaser, and in our opinion both would be served if a legal definition were given to a "*horse power*" as a commercial unit. Exception may be taken to the interference of the Legislature in questions of this kind by those who look with jealousy upon any interference in trade transactions, but we can see no good foundation for such objections. It is as reasonable, and quite as necessary, to establish a standard "Horse Power" as a "Standard Bushel," a "Standard Yard," or a standard for determining the tonnage of ships. Leave the contracting parties to make their bargains by nominal or actual horse power, or by specific dimensions as they think best, but where a contract is made for an engine of so many horse power let us have a legal definition of its meaning.

The rather odd number 33,000 lbs. raised one foot high was adopted by the fathers of the steam engine as expressing the *force* which a good horse, working under favorable circumstances, could exert in one minute of time. The expression was convenient when horses rivalled steam engines, and is now retained because it would be inconvenient to change that which has continued for so great a length of time. One-horse power is therefore equivalent to 33,000 foot pounds—that is 33,000 units of work in a minute. This "*is actual horse power*," and was formerly synonymous with "*nominal horse power*," but at the present time these terms have widely different meanings. The divergence first arose in a desire to give full measure, just as the *cwt.* of 112 lbs. is given for 100 lbs. ; or the heaped bushel for the actual bushel. Later the competition among manufacturers and the wonderful march of improvement in this branch of mechanism, whereby the development of power in a cylinder of given capacity has been doubled, and even quadrupled, has increased the discrepancy, until the constantly widening difference between nominal and actual power culminated in the *Great Eastern*, whose engines of 2,600 nominal horse power have developed an *indicated* or actual power of 8,300 horses.

Actual horse power is liable to many disturbing causes, some of which vary with every change in the dimensions of the machinery, and its final determination can never be arrived at with exactness until the engine is at work and an indicator attached to the determined point at which the force is to be delivered. Numerous attempts have been made to establish a formula for determining from given dimensions and a stated pressure of steam the actual power which an engine will develope, but so much depends on workmanship and on the arrangement and proportion of parts that all these attempts have only modified the value attached to the nominal power.

Where the same rule obtains for determining the nominal power, it is the excess of force developed over the power so determined that forms the true index to the comparative value of the engines pro-

duced by different makers, and were a reliable formula for expressing the actual power of an engine arrived at to-day, it is certain that a year would not elapse without the introduction of some improvement whereby a greater development of force would be effected in engines of the same dimensions. This implies no more than that absolute perfection has not yet been attained, but it shows the practical inutility of endeavouring to settle for commercial purposes the exact force to be developed by an engine of stated dimensions.

Friction is one of the principal causes which affect the development of force; this again is influenced by workmanship, by the due proportion of parts, and by the choice of material. One maker, by the use of well-adjusted self-acting machinery, may succeed in reaching a perfection of workmanship which no amount of individual manual skill can equal. It is this which commonly gives a superior value to engines produced in large establishments where every appliance exists for ensuring perfect adjustment and thorough workmanship.

Back pressure is another element which must be taken into account in estimating the effective force, and this again is largely influenced by the adjustment of the valves and the due proportion of the escape passages. The reduction of pressure occasioned by friction in the steam pipes and condensation of steam during its passage from the boiler to the cylinder is also to be considered, and the allowance to be made therefor is dependent on the distance which the steam has to travel, the extent of radiating surface to which it is exposed, and the amount of wire-drawing to which it is subjected in obtaining access to the cylinder.

The value of the power developed after all these deductions from the normal pressure in the boiler are made, is determined by the *Friction-dynamometer* which measures the force expended in overcoming the friction of a brake applied to the main shaft of the engine. The effective force exerted by the steam in the cylinder is ascertained by the *indicator diagram*, which shews the average steam and back pressure during each stroke of the piston. These diagrams give the data from which the effective force exerted by the steam in the cylinder may be calculated, and from the ease with which such diagrams can be taken, it is at this point that the *indicated* or actual horse power is calculated.

There are several contrivances for taking the indicator diagrams, but all are based on similar principles; that is, the trace made on a coil of paper by a pen, acted on by a piston of definite area, exposed to the pressure of the steam, and resisted by a spring, or weight of known force.

If the pressure thus acting on the pencil is uniform a straight line parallel to the axis of motion is produced, and the area embraced between it and the zero line will at once measure the force exerted during the stroke of the piston. But in practice the lines of positive and negative pressure are curves, and these curves are sometimes very irregular, consequently the area of the diagram must be reduced to an average quantity. Let each pair of diagrams, the one representing the pressure at the back and the other on the front or steam side of the cylinder, during each stroke be divided by a series of vertical lines, with a scale graduated to lbs., measure the height of each line above the zero or atmospheric line, and the sum of the lines divided by their number will represent the mean pressure per unit of surface for the whole diagram, and deducting, in non-condensing engines, the result for the negative or back pressure from that taken on the positive or steam side of the piston, we have the mean effective pressure exerted during the stroke represented by the pair of diagrams.

In condensing engines where the negative side of the piston is a vacuum the curve on the diagram falls below the atmospheric or zero line, and in effect becomes positive pressure. In this case the mean unit of force is arrived at in the same manner, but instead of deducting we either draw the lines across both portions of the diagram and measure the whole together, or add the negative side to the power indicated on the positive or steam side of the piston. The total effective power thus arrived at shews correctly the actual force developed in the cylinder, but a considerable portion of it is consumed in the air-pump. This loss may be approximately represented by the difference between the vacuum pressure in the condenser and the atmospheric pressure plus the weight of the column of water on the pump bucket multiplied by the space traversed by the bucket in each unit of time.

The same process is continued through any number of strokes, and if there are several cylinders attached to the same shaft separate diagrams are taken from each. These diagrams are taken during a determined period; in important cases where the power of very costly engines is to be estimated the process is continued uninterruptedly for days together, and sometimes in steamships during an entire voyage.

The preliminary reduction of the diagrams having been made the formula for obtaining the indicated horse power is simple enough. Multiply the effective mean pressure per unit of surface thus formed by the area of the piston in the same units of surface, say square inches, and by the length of stroke in feet. The resulting product represents the effective force exerted on the piston during one stroke, and when multiplied by the number of strokes per minute and divided by the constant, 33,000 the quotient will give the indicated horse power of the engine.

From the above it will be evident that no measure of power convenient as a commercial unit can be based on the actual force that an engine will develope when at work, and hence the adoption of a nominal horse power for this purpose.

It has already been stated that in the early history of the steam engine the nominal power was intended to, and did approximately represent the actual power developed. Now, however, various rules are adopted by the manufacturers in different districts of Britain, where they have the "*Glasgow Rule*," the "*Manchester Rule*," the "*Leeds Rule*," and the "*Bolton and Watt Rule*." These rules again vary for "condensing" or "non-condensing" engines.

For non-condensing engines, *Bolton and Watt's* rule assumes the speed of the piston to be 128 feet per minute, multiplied by the cube root of the stroke in feet; the mean effective pressure of the steam is assumed to be 7 lbs. per square inch

Then the nominal horse power

$$= \frac{\sqrt[3]{\text{Stroke in feet} \times \text{diameter}^2 \text{ in inches}}}{47} \text{ nearly.}$$

In the south of England this formula is much used, substituting as the divisor 60 for 47. The Admiralty formula is somewhat similar, except that a different speed for the piston is adopted according to the stroke of the engine:—Thus, when the stroke is 3 feet the speed is taken at 180 feet per minute; when the stroke is $5\frac{1}{2}$ feet the speed is assumed to be 216 feet per minute. The effective pressure is always taken at 7 lbs. per inch, and the formula is thus expressed:

$$\text{H. P.} = \frac{\text{Area of cylinder in inches} \times 7 \times \text{by speed of piston in feet per minute.}}{33{,}000.}$$

It is evident that neither this nor the following rules express the actual power of the engine, the result being irrespective of the pressure of steam in the boiler, but they all define with tolerable accuracy the *size*, and consequently the commercial value of the engine so far as the latter is dependant on the capacity of the cylinder.

The *Manchester* rule allows 23 square inches of piston to each nominal horse power without taking any account of the length of stroke, the speed of the piston being considered as a constant quantity, thus:

$$\text{Nominal H. P.} = \frac{\text{Area of piston in inches}}{23}$$

The *Leeds* rule is based on the area of the piston in circular inches, and in practice produces the same result as the Manchester rule, as the area, 30 circular inches, allowed to each horse power is equal to 24 square inches. It is thus expressed:

$$\text{Nominal H. P.} = \frac{\text{Diameter of cylinder in inches}^2}{30}$$

For non-condensing engines the *Manchester* rule allows ten square inches of piston per horse power; or:

$$\text{Nominal H. P.} = \frac{\text{Area of piston in inches}}{10}$$

In *Leeds* sixteen circular inches are allowed, thus:

$$\text{Nominal H. P.} = \frac{\text{Diameter}^2 \text{ in inches}}{16}$$

The *Glasgow* rule is to "square the diameter and point off the unit figure," a process identical in form with the Manchester rule, but less liberal, as it gives circular instead of square inches, the proportion being as 7.854 to 10.

Where compound engines are used, having both a condensing and non-condensing cylinder, it is customary in Leeds to take no account of the small or non-condensing cylinder, but to base the estimated power on the larger cylinder alone.

In estimating indicated horse power, neither the power expended in working the air-pumps, of condensing engines the friction of the machinery, nor the force expended in working the valves, has usually been considered, the power in the cylinder being alone expressed by the ordinary formula:

Indicated horse power =

$$\frac{\text{Mean effective pressure} \times \text{diam.}^2 \times .7854 \times \text{stroke} \times 2 \times \text{No. turns per min.}}{33{,}000}$$

Or indicated horse power =

$$\frac{\text{Effective pressure} \times \text{area piston in in.} \times \text{stroke in ft.} \times 2 \times \text{No. turns per m.}}{33{,}000}$$

lb

62·8 lbs cu' ce

" = ½

80 lb – per sq. in.

In any standard that may be adopted in this country, whether for the engine or for the boiler which supplies it, it is evidently desirable that we should conform as nearly as may be to the average standard which obtains in Britain. The approximation of our unit of measure to that most commonly used by the principal manufacturers is more to be desired than any convenience likely to accrue from the adoption of a standard intended to express more accurately the actual power of an engine. For while in nearly all reliable books of reference on the practical application of steam machinery the calculations as to the *size* of engine requisite for driving a given quantity of machinery are founded on nominal horse power as commonly accepted in Britain, it is not likely that we shall succeed in establishing a totally different standard that will more satisfactorily express the *size* and consequently the cost of production.

For these reasons we propose in determining a standard to adopt a uniform limit for the effective pressure of the steam, and also for the speed of the piston, similar to the limits accepted in England. The determination of the horse power as a commercial unit then becomes a very simple process, and the calculation is based entirely in the area of the piston. Taking the average of British practice the following formula will give us the required standard for condensing engine:

$$\text{Horse power} = \frac{\text{Diameter}^2 \text{ in inches}}{40}$$

$$\text{And, Horse power} = \frac{\text{Diameter}^2 \text{ in inches}}{12}$$

will give the standard for non-condensing engines.

The practice in respect to boilers is even more vague than in respect to the engines; it is usually, however, decided by the number of square feet of heating surface, the quantity allowed varying from four square feet of horizontal area in cylindrical boilers without internal flues, to twenty or even twenty-four feet of surface actually exposed to the action of the fire in multitubular boilers of the locomotive type.

It is obvious that in the above rules the nominal horse power of the engine is altogether irrespective of the boiler, but the indicated power is entirely dependent on the supply of steam, for it is on this that the number of revolutions or strokes of the engine mainly depend. If the steam passages are sufficiently large to permit the flow of the steam to the cylinder without becoming throttled or wire drawn, the indicated power may be increased to the utmost limit which the machinery is capable of withstanding, by increasing the volume and pressure of the steam. This of course involves a corresponding consumption of fuel, and when a certain point is reached this source of power becomes the reverse of economical. Hence it is important that the boiler should be duly proportioned to the size of the cylinder and the speed of the piston.

We shall not now attempt to determine what proportion a boiler should bear to the engine it is intended to supply, for we think that in any standard to be adopted the engine and boiler should be considered separately. But inasmuch as it is a common practice to value the boiler as well as the engine by horse power, a definite meaning should attach to the term.

·7854

80

62·832

It is not so easy to determine a convenient standard for boilers as for engines, inasmuch as the value of the surface exposed to the action of the fire is varied by its position and distance from the furnace. The vertical sides of flues are of less value than their upper surface, the bottoms of flues being generally covered with cinders and ashes are of hardly any value for the generation of steam; hence the practice of allowing so many horizontal feet of sectional area of the whole boiler to each nominal horse power; and although the contrary practice has obtained in proportioning boilers of the locomotive type, we think it much better to base all calculations on the *horizontal* sectional area of the flues and tubes when they are placed horizontally, and on their vertical section when placed vertically, rejecting from our estimate all vertical surfaces except those in the furnace and in immediate contact with the fire. Adopting these principles, although boilers may be divided into several classes, such as cylindrical with and without internal flues, multitubular with either horizontal or vertical tubes, and so on. The following general rule may be applied to all classes, and will very nearly accord with the practice of the best makers' Measure :—

1. The whole internal surface of the fire box above the grate bars, and forming part of the boiler.
2. The horizontal sectional area of so much of the boiler as may be exposed to the action of the fire beyond the fire bridge.
3. The horizontal sectional area of all flues of six inches diameter and upwards.
4. One-half the internal surface of all tubes under five inches when the water surrounds them, or,
4. One-half the external surface of all tubes containing water and exposed to the direct action of the fire.

Add the areas in superficial feet thus obtained together, and divide by *five* for the nominal horse power.

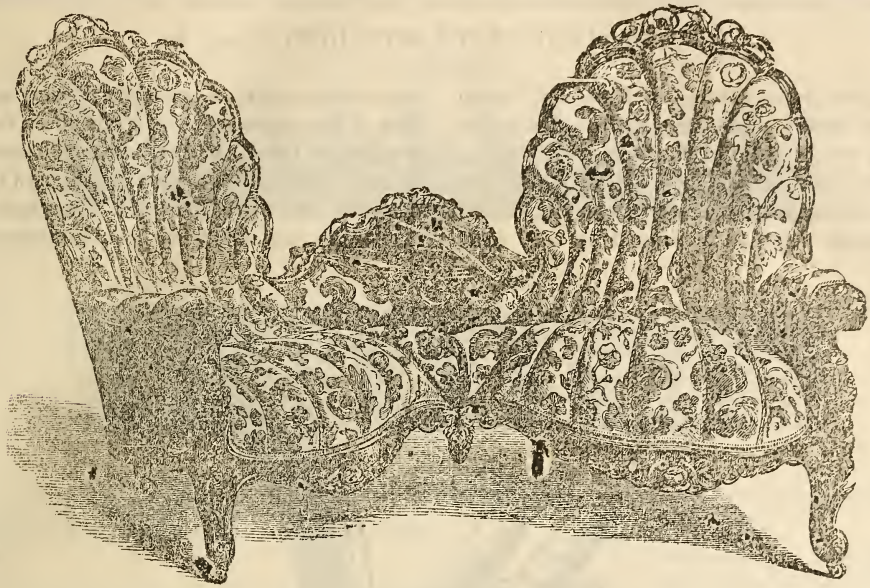
It is not pretended that the quantity of heating surface thus obtained will in all cases be in due proportion to the engine; nor is it possible to frame any rule that would produce such a result. The *quantity* of boiler requisite to drive an engine of a determined size depends very much on the '*actual*' horse power it is proposed to develope, and it might become necessary to order a 20-horse power boiler to accompany a 15-horse power engine, or the reverse proportion might obtain; but in either case the proposed standard would shew the comparative value of the article bargained for, and this is all we at present design.

IMPROVEMENTS IN CANADIAN MANUFACTURES.

There are some people who think we have no manufactures; there are others who do not think it necessary that we should have any, because we can obtain the articles we require cheaper from Europe or the States, and by imposing duties raise means to carry on the government of the country.

It is not our intention to discuss either of these views at present; it is sufficient to know that we can point with pride to medals and honourable mentions at the last International Exhibition held at London, for articles of Canadian manufacture, as illustrations that such as we have are appreciated: and it is well and widely known that many of our manufacturers shrink from sending their goods to London in 1862, not because they do not think they would obtain high commendation, but because they feel that such an exposition of their progress would serve to point out to the British manufacturer the character of the goods most suitable to the country, and the style in which they should be furnished. In Europe all stand on equal or nearly equal ground, and it is a race in intelligence and adaptation which competitors have been running side by side for centuries. In Canada we have our manufactures to build up from a strong youth to a healthy manhood; and while adapting them to the circumstances of the country, to endeavour to secure all the advantages which taste and art can bestow, without lessening other valuable qualities especially suited to the physical and social condition of our country.

Compare the elegant and chaste articles of furniture, which were sent from Canada to London in 1851, with the coarse, heavy, and not less costly, conveniences, for they were nothing more, universal throughout the country previous to that year.



CANADIAN FURNITURE EXHIBITED AT LONDON IN 1851.

We need not reproduce the "old arm chair," or heavy lounge or sofa, which used formerly to be thought highly creditable to our manufacturing industry. And so no doubt they were in the infancy of the country, for we only began to have a youth in 1851. It is a matter of deep regret, nevertheless, that many manufacturers should decline sending to London, because they think it would injure their interests. Perhaps it would injure them by leading after a while to successful competition from Britain. It is a well-known fact that for general adaptation to this country Canadian cloths are manufactured in several parts of the Province, which are superior to those imported at the same price, and which command a ready sale, and are inducing greater efforts to meet the growing demand. The demand is met quietly, without any ostentation such as would be likely to draw too close an attention to what is doing here. Hence in this department of our industry we cannot expect to be properly represented at the Exhibition of 1862. Many enterprising private individuals are benefited, but the country at large is the loser.

Of several other departments of industry in Canada the same tale may be told ; those who have made the most progress, and are capable of producing the best work, shrink from a reputation which they would acquire in Britain, to be succeeded soon, perhaps, by a dangerous or impoverishing competition.

While, therefore, for reasons which are sufficiently indicated in the foregoing paragraphs, we do not think that the articles sent to London this year will be a fair representation of our progress since 1851, and of our present civilization ; yet if we are to rest satisfied with an imperfect impression abroad of the actual condition of the country, as far as home manufactures are concerned, there is no reason why all Canadians should not contribute their best to the Provincial Exhibition to be held in Toronto in September next ; it will engender a local rivalry beneficial to all, and there is much less fear that general admiration will be associated with future dangerous competition.

BRITISH MERCANTILE STEAM FLEET.

The steam fleet of Great Britain has contributed incalculably to her pre-eminence as a commercial nation. Indeed, few have any adequate conception of the rapid growth of this important interest, or the extent already attained. It appears from an official return, that at the commencement of the present year, 1,945 steamers were registered in the United Kingdom, of a gross burden of 686,417 tons, being an increase of 82 vessels and 19,904 tons, as compared with the corresponding date of 1860. The number of paddle steamers was 1,312; of screws, 601. As regards the materials of which they were constructed, 860 were built of wood, 1,080 of iron and five of steel. Of the whole number of steamships, 515 are owned in London and 214 in Liverpool. The scale of operations entered upon by some leading steamship companies of England are enormous. First in importance, as concerns the United States, is the "Cunard fleet," comprising no less than thirty large steamers, averaging not far from 2,000 tons. The largest of these is the new steamer "Scotia," which measures 4,000 tons, and three more powerful ships will soon be added.—*Hunt's Merchant Magazine.*

ROWAN'S MACHINE FOR SCUTCHING FLAX, &c.

This invention, introduced by Messrs. J. Rowan & Sons, of Belfast, consists in scutching flax, hemp, and other fibrous materials by means of a revolving cylinder fixed in a frame, round which cylinder are placed combs and beaters, and to which the flax or other fibrous material is pressed by the hand through an opening provided for the purpose in the front of the machine. After having been sufficiently acted on, the flax is withdrawn and reversed end for end; this done, it is then put through the same operation, when it is finished. Sometimes rollers are used to pass the flax or hemp into the machine.

Fig. 1.

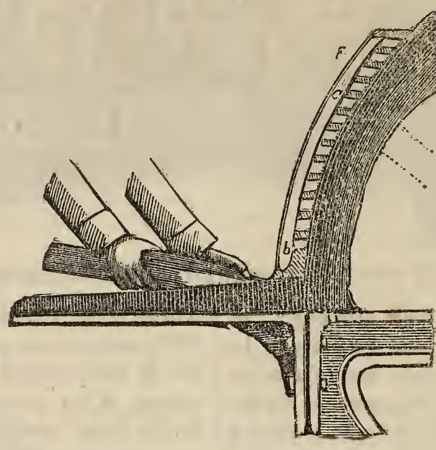


Fig. 2.

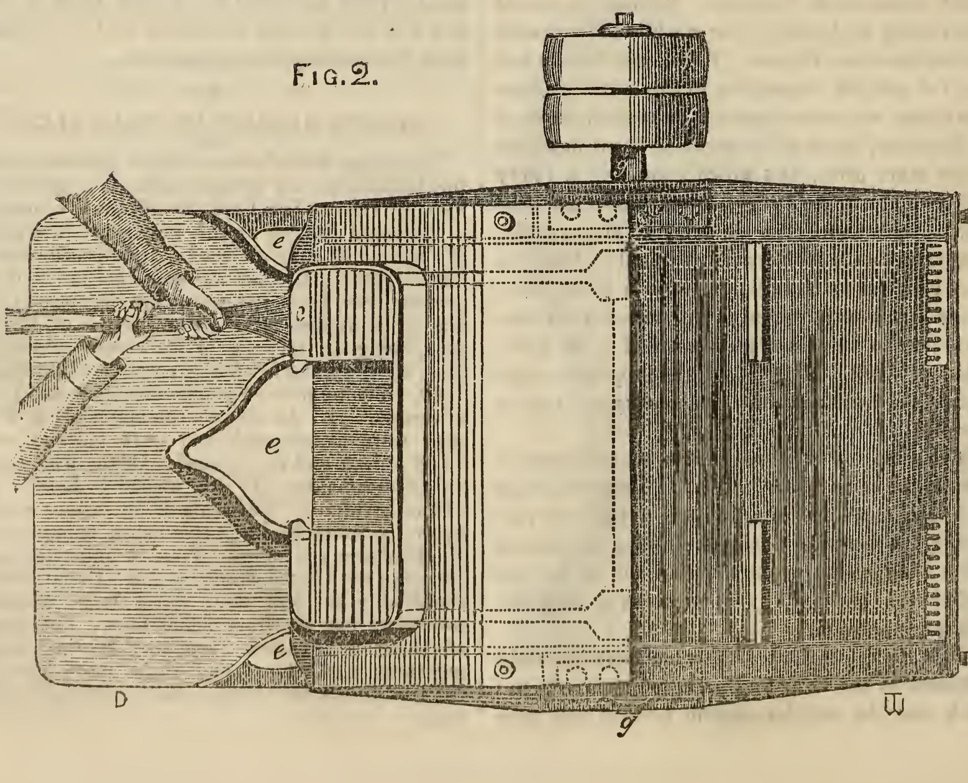


FIG. 3.

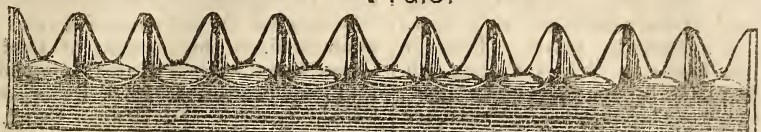


FIG. 4.

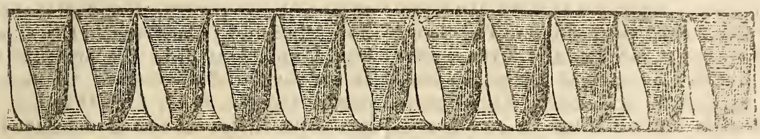


Fig. 1 of the accompanying engravings is a partial side elevation, and Fig 2 a plan of the machine.

a, *a*, is the revolving drum or cylinder mounted on a shaft or spindle *g*, and fitted with a comb *h*, and with beaters *s*, *s*, round its periphery. One comb and five beaters, are found to act well, but the number of either may be altered. Figs. 3 and 4 are views on an enlarged scale in front elevation, and plan, of a comb detached, B is a side or frame-work enclosing the upper part of the drum ; *C*, *C*, are louvre plates inclining downwards to allow of the broken boon or woody particles detached from the flax or other fibre under treatment passing off freely, and being blown down to the floor by a current of air passing from the cylinder through the louvres. The object of the louvres is to prevent the boon getting embedded with the fibre. *D* is the feeding board ; it is made as shewn to enable the attendant to feed and handle the straw and flax during the operation with safety. A set screw is connected to the plate *b* for the purpose of regulating the distance thereof from the comb and beaters, which distance requires to be modified according to the nature of the fibres being operated on. *F* is the front plate of the louvre casings, *c*, *c*, are passages or channels by which the boon is led to the openings *e*, *e*, through which it falls to the ground ; *f f* are fast and loose pullies mounted on the spindle *g*. The flax, hemp, or other material to be scutched is fed by the hands of an attendant to the drum or cylinder by means of the board *D*, and is submitted to the action of the comb and beaters ; the material is allowed to pass on into the machine until one hand of the attendant comes nearly in contact with the front plate *F*, when the material is withdrawn, turned upside down, re-inserted, and submitted to the same operation, and so on until it is sufficiently scutched.—*Mech. Mag.*

COMMERCIAL PROGRESS OF THE NINETEENTH CENTURY.

The discoveries, inventions and progress noted in three centuries, ending with the year 1800, have all been eclipsed by the astonishing events of the present century. The application of steam as a propelling power may be considered as the most important of these changes. The next of importance to the world may be said to be the rail-road —not only in developing production, but as a means of civilization, and in bringing together remote interests. The vast commercial interests of the world have been more fully promoted by the invention and use of the magnetic telegraph—an invention for which the civilized world is largely indebted to the genius of Professor Morse. While the progress and changes in the physical world have been greater than at former periods, the reform and changes in the science of law and government, and in the social condition of men, have been still greater. Among these revolutions we may name—first, the modification of the Corn Laws of England, after centuries of obstinate legislation ; second, the introduction of cheap postage ; third, the adoption of general laws for corporations, in lieu of special charters. Science has at the same time demonstrated the importance of gutta percha to the world. Steamboats and steamships have been introduced into the waters of all parts of the world. Twenty-five thousand miles of rail-road now penetrate the remotest corners of the United States. The population of the United States has increased from 5,300,000 at the opening of the century to about 30,000,000 in the year 1858. The number of post-offices has increased in the same time from 903 to 27,000, and their revenue from $280,000 to $8,000,000. The tonnage of the Union has increased from 1,000,000 tons to 5,000,000—the foreign imports from $91,000,000 to $350,000,000, and the customs revenue from $9,000,000 to $64,000,000. The discovery of gold in California and in Australia has led to the further development of commerce, navigation, manufactures and trade ; and the rapid changes still going on would indicate that the next fifty years will be as prolific as the last half century.

1801—1810.—Embargo laid (January, 1801) on all Russian, Danish and Swedish vessels in English

ports. 1802. Santee Canal, South Carolina, completed. 1803. Louisiana sold by France to the United States for $15,000,000. The first printing press in New South Wales established at Sydney. Caledonian Canal opened for travel. Trial of steamboat on the Seine, by Robert Fulton, 9th August. The first bank in Ohio chartered. 1804. Wilberforce's slave-trade bill rejected by the House of Lords. The Code Napoleon adopted. Ice first exported from the United States to the West Indies. 1805. The Gregorian calendar again adopted in France. 1806. The Cape of Good Hope surrendered to the English. Abolition of the slave-trade by English Parliament, 10th June. The loom invented by Jacquard, a mechanic of Lyons, purchased by the French Government for public use. East India Docks opened at London, 4th August. 1807. Milan decrees against English commerce, 11th November. Fulton's first voyage on the Hudson. The Bank of Kentucky chartered. First manufactory of woollen cloths in the United States established at Pittsfield, Massachusetts. Middlesex Canal, Massachusetts, completed. 1808. Manufacturing districts of Manchester, &c., petitioned for peace. 1810. Deaths, by suicide, of Abraham Goldschmidt, Francis Baring and other English merchants.

1811—1820.—English guineas publicly sold for a pound note and seven shillings. 1811. Mr. Horner's proposition for resumption of cash payments in England rejected. First Steamboat built at Pittsburgh. 1812. Serious riots in the manufacturing districts of Lancashire and Yorkshire. Declaration of war by the United States against England, 18th June. 1814. London *Times* first printed by steam, 20th November. 1815. Veto of the United States Bank bill by President Madison; bank re-chartered for 20 years. 1816. The new Russian tariff prohibited the importation of nearly all British goods. Bank of England advanced £3,000,000 further to government, making a total of £14,000,000. 1817. Paris first lighted with gas. First steamboat from New Orleans to Louisville. 1818. First Polar expedition of Captain John Franklin left England. Steamboats built on Lake Erie. 1819. Emigration to Cape of Good Hope encouraged by the British Government. The steamship *Savannah* arrived at Liverpool from the United States, 15th July. Commencement of the suspension bridge over the Menai by Telford. The first bank in Illinois chartered. 1820. Florida ceded to the United States by Spain. Suspension bridge over the Tweed. First steamer ascended the Arkansas River.

1821—1830.—Captains Parry and Lyon's expedition to the Arctic Ocean left England, 30th March. 1821. Bank of England resumed specie payments. 1822. Funeral of Coutts, the London banker, 4th March. The first cotton mill in Lowell erected. 1823. Revival of business in the English factories. 1824. Advance in the prices of agricultural produce in England. Act passed for the Thames Tunnel, 24th June. Fauntleroy, banker, hung for forgery, 30th November. Champlain Canal, New York, completed. 1825. Panic in the English money market, December. Failure of numerous country banks. Erie Canal completed. 1826. Mr. Huskisson's free trade policy advocated in the House of Commons by vote of 223 to 40. Coin in Bank of England reduced to £2,460,000, 28th February. 1827. Commercial confidence restored in England, and employment for the poor. "Society for the diffusion of Useful Knowledge" established, at the instance of Lord Brougham. Union Canal, Pennsylvania, completed. Quincy Rail Road completed. 1828. Delaware and Hudson Canal, Syracuse and Oswego Canal, New York, completed. India Rubber goods manufactured at Connecticut. 1829. Increase of silk manufactures in England, and reduction of duty on raw silk. Prize awarded to Mr. Stephenson for his locomotive engine on the Liverpool and Manchester railway. Subscription by Congress to the Chesapeake and Ohio Canal, May 3rd. Departure of Captain Ross on his voyage of discovery. Chesapeake and Delaware Canal opened, 17th October. 1830. Opening of the Liverpool and Manchester Railway, 15th September. Free navigation of the Black Sea opened to the United States by treaty, 7th May. Charles X. fled from Paris, 31st July. West India trade with the United States opened to British vessels. Independence of Belgium acknowledged. Pennsylvania State Canal finished.

1831—1840.—Parliamentary reform bill introduced in 1831 by Lord John Russsll; rejected by the House of Lords, 8th October. Free trade convention at Philadelphia, October 1. Stephen Girard died, 20th December, aged 84. Insurrection in Jamaica, 28th December. 1832. Veto of United States Bank Bill by President Jackson, 10th July, New tariff act passed by Congress, July. Ohio State Canal finished. Albany and Schenectady Rail Road, Columbia Rail Road, Pennsylvania Rail Road, Newcastle and Frenchtown Rail Road, completed. 1833. Ice first exparted to the East Indies from the United States, 18th May. Opening of the China trade to the English. East India Company charter renewed; ceased to be a commercial body. Bank of England charter renewed. Usury restrictions removed in England from all commercial paper having less than three months to mature. Mr. Clay's tariff bill passed by Congress. Removal of the deposits from the United States Bank, September. 1834. The Chinese suspend intercourse with the English at Canton. The first bank in Indiana chartered. London and Westminster Bank commenced business, March 10. Resolution of the United States Senate condemning President Jackson for removal of deposits, March. Nomination of Roger B. Taney as Secretary of the Treasury, rejected by vote of 28 to 18. Abolition of Slavery in British West Indies. Baltimore and Ohio Railroad opened for travel to Harper's Ferry, 1st December. Bank of Maryland failed, 24th March. 1835. French Indemnity bill passed, 18th April. Baltimore and Washington Railroad opened for travel 23rd August. Bank of Maryland Riots in Baltimore, 8th August. Loss of $20,000,000 by fire in New York, 16th December. Boston and Providence Rail Road, Boston and Worcester Rail Road, completed. 1836. Charter of United States Bank expired, March 4, and succeeded by Pennsylvania United States Bank. Reduction of the newspaper stamp duty in England, 15th September. Failure of the Commercial and Agricultural Bank of Ireland. Anthracite coal used for steamboats on North River. Independence of South American Republics acknow-

ledged by Spain, 4th December. 1837. Panic in the London market, June. Failures of American bankers in London. Further modifications of the usury laws of England. Failure of banks in the city of New York, May 10. Grand Junction Railway, England, opened, 4th July. Revolt in Canada. Mont de Piété, Limerick, established. 1838. Railway opened from London to Southampton, 17th May. Wreck of the *Forfarshire;* heroism of Grace Darling, September 5. Royal Exchange, London, burned, 10th January. Resumption of specie payments in New York, May. Sub-Treasury bill defeated in Congress, June. United States Exploring Expedition, under Captain Wilkes, left Hampton Roads, 19th August. Imprisonment for debt abolished in England. 1839. British trade with China stopped, December. Second suspension by the banks at Philadelphia, 9th September, followed by bank failures in the South and West. Western Rail Road, Worcester to Springfield, opened, 1st October. Union Bank, London, commenced business. 1840. Penny postage adopted in England. Antartic continent discovered by Wilkes, 19th January. First steam vessel at Boston, arrived from England, 3rd June. First Cunard steamer (the *Britannia*) arrived at Boston, 18th July; and the *Acadia*, 17th August. Fiscal Bank Bill vetoed by President Tyler, 16th August. Bankrupt bill passed by Congress, 18th August. Bill for distribution of public lands passed by Congress, 23rd August. Fiscal corporation bill vetoed by President Tyler, 9th September. Loan of $12,000,000 authorized by Congress.

1841—1850.—The island and harbor of Hong Kong ceded (1841) by the Chinese to England. Pennsylvania United States Bank failed third time, 5th February, and made an assignment, 4th September. Union of Upper and Lower Canada, 10th February. Foreign trade of Canton suspended, and hostilities with the English renewed, 21st May. Canton taken, 27th. American clocks exported to England. 1842. Anti-corn law movement in Parliament by Sir R. Peel. Capt. Wilkes returned from his exploring expedition, 11th June. Ashburton treaty ratified by the Senate, 20th August. British treaty with China, (29th August,) by which it was agreed to open five free ports. 1843. Return of Captain Ross from the South Pole, 6th September. Treaty of commerce, by Sir H. Pottinger, with China. 1844. Treaty of annexation of Texas to the United States rejected by the United States Senate, 8th June. Anti-rent riots in New York, August. Re-charter of Bank of England. Magnetic telegraph between Baltimore and Washington. Cheap postage act of United States went into operation, July 1. 1845. Treaty between United States and China ratified by United States Senate, 16th January. Sir John Franklin left England, 25th May, on his Arctic expedition. Anti-corn law league at Manchester. Steamship *Great Britain* arrived at New York, 10th August. Treaty of annexation of Texas ratified by the United States Senate, 1st March. Loss of $6,000,000 by fire in New York city, 19th July. Peel ministry resigned, 11th December. 1846. Oregon treaty between England and the United States, signed in London, 17th July. Second failure of the potato crop in Ireland. Steamship *Great Britain* stranded in Dundrum Bay, 22nd October. Declaration of War with Mexico by the United States, 12th May. New tariff bill passed by Congress, 28th July. Veto of French spoliation bill by President Polk, 8th August. 1847. Gold in California discovered. United States ship *Jamestown*, left Boston, 28th March, and frigate *Macedonia*, 18th July, with provisions for the relief of the Irish. Great commercial distress throughout Great Britain, September to November. 1848. The State of Maryland resumed payment of interest, 1st January. Treaty of peace between Mexico and United States, signed 30th May. Suspension bridge at Niagara Falls completed, 29th July. Edict to incorporate Bank of France with nine branches, 27th April. India-rubber life-preservers invented. 1849. Penny postage adopted in Prussia. First experiment of a submarine telegraph at Folkstone. 1850. Invasion of Cuba by Lopez. £20,000 reward offered by Parliament for discovery of Sir John Franklin, 8th March. Collins' line of steamers to Liverpool commenced operations. Steamer *Atlantic* left New York, 27th April. The celebrated Koh-i-noor diamond, valued at $2,000,000 brought to England, July

1851.—The London exhibition opened, May 1. Contract of Pacha of Egypt with Mr. Stephenson for a rail-road from Alexandria to Cairo. Railways completed between St. Petersburgh and Moscow, Dublin and Galway. Collins' steamer *Pacific*, arrived in Liverpool, May. Yacht *America* won the race at Cowes, 22nd August. Hudson River Rail-road opened to Albany, 8th October. Dr. Kane returned from the Grinnell expedition, October.

1852.—Construction of French Crystal Palace ordered, February. Expedition of United States naval forces to Japan, March. Dr. Rae returned from his search for Sir John Franklin, February. Ship *Prince Albert* returned from search for Sir John Franklin, 7th October.

1853.—Trial trip of the caloric steamship *Ericsson* from New York to the Potomac, 11th January. Second Arctic expedition left New York, 31st May. American expedition arrived at Japan, 8th July. Loss of the steamship *Humboldt*, 5th December.

1854.—Combined fleets of England and France entered the Black Sea, 11th January. Loss of the steamer *San Francisco*, 5th January. Steamer *City of Glasgow* lost, March. Declaration of war by England against Russia in behalf of Turkey. 28th March. Commercial treaty between United States and Japan. French loan of 250,000,000 francs, announced March 11, and Turkish loan of £2,727,400. London joint-stock bankers admitted to the clearing-house, June 7. Crystal Palace at Sydenham opened, 10th June. Bombardment of San Juan by ship *Cyane*, 13th July. Loss of steamer *Arctic*, 27th September. Captain McClure returns from Arctic discovery, 28th September.

1855.—Discovery of Captain Franklin's remains. £10,000 awarded Captain McClure by Parliament. Paris exhibition opened 15th May. Submarine telegraph wire laid in Black Sea. Resistance by United States to payment of Sound Dues. First rail-road train crossed the Suspension bridge at Niagara, 14th March. French loan of 500,000,000 francs taken, 18th January. Suspension of Page, Bacon & Co., Adams & Co., San Francisco, 22nd

February. English loan of £16,000,000 taken by Rothschilds, 20th April. Ships *Arctic* and *Release*, Captain Hartstein, left New York for relief of Dr. Kane and party.

1856.—The Arctic discovery-ship *Resolute*, was delivered to the British authorities at Portsmouth, 30th December.

1857.—Expulsion of James Sadleir from the House of Commons, for fraud, February 16. Trial trip of the United States frigate *Niagara*, April 22nd. Count D'Argent, Governor of the Bank of France for 21 years, resigned, May. Suspension of Ohio Life and Trust Company, New York, August 24. Suspension of the banks of Philadelphia, Baltimore, &c., September 25. New York banks suspended October 14. Suspension of Wilson, Hallett & Co., Liverpool; Hodge & Co., Liverpool; John Monroe & Co., bankers, Paris, and numerous others, November. Suspension of Bank of England charter, November 12. Severe storm on north coast of Scotland, November 23. Resumption of specie payments by New York banks, December 14. Canton bombarded by the English and French, December 28.

1858.—Attempt to assassinate the Emperor Napoleon, 14th January. Loss of the *Ava*, mail steamer from Calcutta to Suez, 1st February. The Livingston exploring expedition sailed from Liverpool, 10th March. Conference at Shanghai of the representatives of Great Britain, France, Russia and the United States, 30th March. Great fire at Christiana, Sweden, destroying three-quarters of the city, 13th April. Forts at the mouth of the Peiho, near Pekin, captured by the English and French forces, 20th May. Treaty between Great Britain and China. signed at Tietsin, 26th May. A new boundary treaty between Turkey and Persia, signed at Constantinople, 29th May. Convention agreed to for the suspension of hostilities between the Turks and Montenegrins, 5th June. Jeddah bombarded by the British ship *Cyclops*, 23rd July, and again on 5th August. Second treaty between United States and Japan signed, July 28. Lord Elgin landed and negotiated, at Jeddo, a treaty between Great Britain and Japan, 12th August. Important financial reforms adopted by the Sultan of Turkey, 18th August. Message by Atlantic Telegraph, from Queen Victoria to President Buchanan, 22nd August. The Hamburg screw-steamer, *Austria*, burned at sea; upwards of 400 of the passengers and crew were lost, 13th September. Crystal Palace at New York destroyed by fire, 5th October. Royal proclamation issued throughout India, announcing transference of authority of the East India Company to the home government, 1st November.

1859.—Death of Baron Humboldt, aged 92 years, May 6. English and French forces accompany the English and French ambassadors to the Emperor of China; repulsed on attempting the passage up the Peiho River, with a loss of about 450 men, 25th June. The island of San Juan, Oregon, taken possession of by Gen. Harney, in the name of the United States government, 1st July. Terrific gale, causing extensive loss of life and property, over England, and on the coasts, October 26. Severe gale through the southern districts of England, 1st November. The steamship *Indian*, from Liverpool, wrecked upon Seal Ledge, 65 miles east of Halifax; 24 of the passengers and crew lost, 21st November. First train passes over Victoria Bridge in Canada, 24th November.

1860.—Peace is concluded between Buenos Ayres and the Argentine Confederation, January 5th. Falling of the Pemberton Mills at Lawrence, Mass., 10th January. United States five per cent. loan, $1,100,000, negotiated, January 31st. First silver bullion received from the Washoe silver mines. A treaty signed between France and Sardinia for the annexation of Savoy and Nice to France, 24th March. The Japanese Embassy arrives at San Francisco, 29th March. First pony express reaches Carson Valley in 8½ days from Missouri, 12th April. Attack on the Bank of England by Messrs. Overend, Gurney & Co., bankers, defeated, April. Fraud in Union Bank of London discovered, April 23rd; loss £263,000. Fraud in Pacific Mail Steamship Company stock discovered at New York, May 18. News received in London of the failure of the Red Sea telegraph, May. President Buchanan vetoes Homestead Bill, and it is lost, 23rd June. Failure of Streathfield, Laurence & Co., and other houses in the leather trade, London, July. The Taku forts at the mouth of the Peiho are taken by the Allies, after a strong resistance by the Chinese, 21st August. United States ten million five per cent. loan taken, 22nd October. Great panic in New York stock market, November 12. Georgia Banks suspended payment, November 30. Steamer *Persia* arrived at New York from Liverpool with $3,000,000 in gold. South Carolina secedes from the Union, 20th December. Fort Moultrie evacuated by Major Anderson, 26th December. Castle Pinckney and Fort Moultrie seized by State authorities, 28th December. John B. Floyd resigns as Secretary of War, 29th December. Bank of England raised rate of discount from five to six per cent., 31st December. Robbery of $173,000 belonging to English bondholders, by the Mexican government, December. Prospectus of Turkish six per cent. loan issued by M. Mires, Paris.

[The preceding sketch is mainly from *The Cyclopædia of Commerce and Commercial Navigation*, published by Messrs. Harper & Brothers, N. Y., 1859,]—*Hunt's Merchants Magazine.*

Board of Arts and Manufactures

FOR UPPER CANADA.

PROCEEDINGS OF THE BOARD.

The first meeting of the Sub-Committee elected for the current year, was held at the Board Rooms, Toronto, on the 29th of January, at 1 P. M. The members present were the President (Dr. Beatty), the Vice-President (Dr. Craigie), and Messrs. Professor Buckland, A. Brunel, T. Sheldrick, W. H. Sheppard, Professor Hind, R. Bull and P. Freeland.

Minutes of annual meeting, and letters from the agents for the Journal were read, and some accounts passed.

The Secretary submitted an estimate of necessary working expenses of the Board for the current year, exclusive of any appropriations for Books for the Library of Reference, amounting to $1,935 00, which was received.

Moved by T. Sheldrick, seconded by R. Bull, and resolved:—

"That Professor Buckland, A. Brunel, P. Freeland, Professor Hind and the Secretary, do constitute the *Journal and Book Committee*, for the current year."

Resolved:—"That the sum of two hundred dollars be appropriated to the *Journal and Book Committee* for the purchase of books for the Library."

Moved by A. Brunel, seconded by T. Sheldrick, and resolved:—

"That in order to induce contributions to the Journal, the sum of five dollars ($5) be offered for each page of original matter accepted by the Editor—only such articles as treat on Mechanics, Manufactures, and the production and preparation of raw material for manufacturing purposes to be accepted."

Moved by Professor Hind, seconded by Mr. Sheldrick, and resolved:—

"That the President, Mr. Freeland, Mr. Brunel and the Mover, be a committee to draw up an address to the Government relative to the renewal of annual grants to the Mechanics' Institutes and Arts Associations throughout Canada, in accordance with the instructions of the Board."

Resolved:—"That Mr. J. E. Pell be requested to act as agent for the Journal of the Board in the City of Montreal."

"Resolved:—"That at the meeting of Delegates to be held on the 30th instant, to consider the Act introduced during the last session of the Legislature to amend chap. 32 of the Consolidated Statutes of Canada, the President and members attending be instructed to advocate the adoption of the several clauses proposed by this Board, as published in the Journal of the Board for April of last year."

The meeting then adjourned.

W. Edwards.
Secretary.

CONVENTION OF DELEGATES.

In accordance with a resolution adopted at the Annual Meeting of the Directors of the Provincial Exhibition Association, held in London in September last, a Meeting of Delegates of the various County Agricultural Societies, Horticultural Societies, and Board of Arts and Manufactures in Upper Canada, was held in the Lecture Hall of the Toronto Mechanics' Institute, on Thursday the 30th of January.

About sixty Delegates were present at the Meeting, including the President, Secretary, and Members of the Board of Agriculture; and the President, Vice-President, Secretary, and Messrs. Rice Lewis, Thos. Sheldrick, W. H. Sheppard, H. E. Clarke, W. S. Lee and H. Langley, of the Board of Arts and Manufactures.

Col. Thomson, President of the Board of Agriculture was elected Chairman, and explained that the Meeting was called to take into consideration a Bill introduced to the Legislature during its last session, to amend the Act under which the several Agricultural Boards and Societies, Horticultural Societies, and Boards of Arts and Manufactures are now constituted; and that the Bill referred to had passed the Legislative Assembly, and after two readings in the legislative council had been submitted to a special committee, who had not reported the Bill on account of its altogether doing away with the Agricultural Association, that have been in existence for so many years, and allowing the Boards of Agriculture, and the Boards of Arts and Manufactures, each to hold Provincial Exhibitions, with power granted them under the proposed bill to unite whenever they may see fit so to do; and also providing for the Election of the Members of the Board of Agriculture by twelve Agricultural Districts in each section of the Province, according to a schedule annexed to the Bill. The Chairman requested the Meeting to make its views known in respect to these two important changes, and also upon the bill generally.

Major Campbell, M. P. P., attended on behalf of the Board of Agriculture for Lower Canada, and at the request of the meeting gave some general explanations in connection with the changes proposed in the Bill under discussion. Major Campbell in his remarks applied himself principally to the Boards of Agriculture and the Agricultural Associations; but stated as a reason for the action of the Committee of the House in separating the Boards of Agriculture and the Board of Arts and Manufactures for Exhibition purposes, that it was thought that Agriculture was now strong enough to walk alone; and with regard to the dissolution of the Provincial Agricultural Associations, that certainly was discussed in the Committee, and it was felt that if the members of the Boards of Agriculture were elected in the manner he [Major Campbell] had stated, that they would then fully represent the agricultural population, and there would be no necessity for sending up delegates every year merely to choose the next place at which to hold the Exhibition and to elect the officers of

the Society. Major Campbell concluded his remarks by assuring the meeting that the Lower Canada Society did not in the least desire to dictate. He merely appeared to explain the views they held.

The several clauses of the Bill were then taken up *seriatim* by the meeting, and a very interesting discussion took place thereon. Several minor amendments were adopted, but the three propositions upon which the principal and most interesting discussion took place, were:—

1st. The mode of electing the members of the Board of Agriculture.

2nd. Granting legislative aid to Horticultural Societies.

3. Abolishing the Agricultural Associations, and giving the Boards of Agriculture, and the Boards of Arts and Manufactures power to hold separate exibitions.

On the first of these questions it was moved by Mr. Ruttan, and seconded by Dr. Craigie, "that the present mode of electing the members of the Board of Agriculture is unsatisfactory, and that in future each County Agricultural Society shall at their annual meeting in January, elect one delegate, all of which delegates shall meet at——, on the first Tuesday in February, and then and there shall elect eight gentlemen who shall form the Board of Agriculture."

Mr. Barker moved—"That the several county societies shall at their annual meeting name two persons to act as delegates, who shall at the meeting of the Provincial Association have each a voice in the election of the Board of Agriculture, and the election of such member shall take place on the evening of Thursday in the first week of the exhibition."

Mr. Barker's amendment was carried by a majority of two.

On the second question it was moved by the Hon. Mr. Alexander, seconded by Mr. Beadell, and Resolved,—"That every Horticultural Society in any city, town or incorporated village, incorporated under this act, or which may have been incorporated under any other act of the Provincial Legislature, shall be entitled to a public grant, equal to the amount subscribed by the members of each society and certified by their Treasurer to have been paid into his hands in the manner provided by the section of the act relating to Agricultural Societies, provided that the whole amount granted to any such society shall not exceed $400 in any year.

On the discussion of the third proposition, Dr. Beatty (the President of the Board of Arts and Manufactures for Upper Canada,) said:—

The clause now under discussion provides for the separation of the Boards of Arts and Manufactures and the Boards of Agriculture, in both sections of the province, in regard to the Provincial Exhibitions—in the management of which, a Union of these Boards alone exists, under the present Act This separation is desired in Lower Canada, but not in Upper Canada. Some gentleman had indeed said that Arts and Manufactures are able to "walk alone." But how are they able to "walk alone?" Agriculture receives a public grant in each section of the Province of about $52,000 a year, and Arts and Manufactures only $2,000. Unless the Legislature bestows a more liberal grant on the Arts and Manufactures than heretofore, they can not walk alone just yet.

It has been stated by some gentleman present, that whilst the Agriculturist has to pay a rent for a miserable shed for his cattle, the funds of the Association are expended in erecting a Palace for the accomodation of the Arts and Manufactures.

He wished gentlemen to recollect, that the Exhibition Buildings are not erected at the expense of the Association, but of the localities in which the Exhibitions are held; and further, that at least one-half of the main building is always occupied with Agricultural and Horticultural products and implements, and the manufactures of the farmers and their families; and in the matter of prizes, by referring to the published transactions of the association, gentlemen would see that no more than from one-sixth to one-fifth of the prizes at these exhibitions are awarded in the Arts and Manufactures department, and that a considerable proportion of this also is taken by the wives and daughters of our Agriculturists.

He would also caution the Agriculturists against cutting off what is, to a very large proportion of those who attend, one of the most attractive features of these exhibitions, and which brings in so large a revenue towards paying the prizes and general expenses. This fact is evidenced by the crowds of visitors that constantly press into the main building from the commencement to the close of the exhibition.

Dr. Beatty went on to defend the present Union on the ground of economy in the expense of managing one united exhibition, instead of two separate ones, and in the public being able to visit and inspect the Agricultural, Horticultural, and Arts and Mechanical productions of our country at one expense and loss of time from their business; and concluded by moving the following resolution, which was all but unanimously adopted by the meeting:—

"That this meeting disapproves of the separation of the Board of Arts and Manufactures and the Board of Agriculture, so far as relates to the holding of joint exhibitions in Upper Canada, as proposed by the bill under discussion."

Dr. Beatty read a number of clauses relating to the Boards of Arts and Manufactures, agreed upon by the Board.

Mr. Beadell, seconded by Col. Denison, moved that they be approved by the meeting. Carried.

[The clauses referred to were published in the April number of the *Journal*, and having been previously well considered elicited no debate.]

The meeting next proceeded to consider a number of clauses proposed by the Board of Agriculture and the Board of Arts and Manufactures for Upper Canada, as an addition to Major Campbell's bill, immediately following the clauses constituting the Boards of Arts and Manufactures. These proposed additions were also published in the April number of the *Journal*, and were adopted by the meeting without discussion.

Mr. Sheldrick moved, seconded by Mr. Solmes, that the Presidents and Secretaries of the Boards of Arts and Manufactures, and of the Boards of Agriculture, be a committee to draft a Bill in accordance with the action of this meeting, and to print a sufficient number to be distributed among the different Societies of the Province, the members of the Legislature and of this Convention.

Col. Denison moved that the draft be published in the *Journal* of the Society.

The Resolution with Col. Denison's amendment was carried.

Mr. Cooley moved, seconded by Mr. Barker:

"That Messrs. Allan, Christie and Denison be a committee to draft an address of condolence to Her Majesty, and that it be signed by the Chairman on behalf of the meeting." Carried.

The World's Fair.

Col. Thompson said he was one of the commission for collecting articles for exhibition in London. Parties desiring to exhibit were requested to send in their samples to London, C. W., by the 18th of this month; in Hamilton, by the 20th; Toronto, by the 22nd; Kingston by the 24th. A general selection would be made at Montreal by the commissioners. The goods have to be in England by 31st of March. The share allotted for the exhibition of Canadian products was not so large as in 1851, but it was to be feared that even it was more than would be wanted. The Government had only placed $6,000 at their disposal this year. In 1851 they placed $60,000, and for the Paris Exhibition $80,000. However, the Commission were determined to do the best they could.

Mr. Edwards stated that some few cases had come to his knowledge, of manufacturers objecting to send specimens of fine or expensive manufactures for the inspection of the Commissioners at the places named, if a selection would again have to be made by the Commissioners in Montreal, after a previous inspection and selection by the Commissioners for Upper Canada. He hoped it was not yet too late for the Commissioners to reconsider their decision in this matter.

The chair was then taken by Mr. Barker, when a vote of thanks was given to the Chairman, Col. Thomson, and the Convention adjourned, after a sitting of eleven hours.

INTERNATIONAL EXHIBITION OF 1862.

We call the attention of our readers to the day appointed by the Commissioners for Canada at the International Exhibition of 1862, to meet at Toronto, with a view to examine and approve of articles for transmission to Europe. The 22nd February is near at hand, when, according to their advertisement, the Commissioners will be present in this city. We hope that they will meet with encouragement from all parties able to uphold the character which Canadians obtained in 1851. Such an opportunity as the present will, in all probability, not occur for another ten years; and every mail from Europe brings accounts of the energy, activity and emulation exhibited, not only on the other side of the Atlantic, but in nearly all the British dependencies throughout the globe.

THE PROVINCIAL EXHIBITION FOR 1862.

Little, we fear, has as yet been done to make preparations for the next Provincial Exhibition; nevertheless the months between February and September will rapidly pass away. Spring is fast approaching with its busy days, when other subjects will engage the attention of those who are most able to work out the details of the plans which should be adopted without delay for securing an enlarged prize list, more ample accommodation, a considerably greater extension of time for the exhibition of arts and manufactures, and a new organization of judges and other authorities. Upon the nature and extent of these *preliminary* operations made months before the exhibition, much of its importance and superiority will depend.

TO SUBSCRIBERS TO THIS JOURNAL.

Our subscribers will please bear in mind that the price at which the Board of Arts submits this Journal to the public, whether to single subscribers, clubs of ten or more, members of mechanics' institutes or agricultural societies, is so low that that the proceeds of a circulation, however extended, could not meet even the bare cost of publication. In view of this they are respectfully requested to *transmit* their subscriptions to the Secretary of the Board, W. Edwards, Esq., at the earliest convenient period; as any attempt at the collection of subscriptions as a business transac-

tion in the ordinary way is out of the question. The more extended the circulation becomes, and the more promptly the subscriptions are paid, the greater will be the efforts which the Board will be justified in making to advocate the cause of the manufacturer and the artizan in the Province.

CONTINUATION OF GEO. E. PELL'S REPORT.

(*Continued from page* 11.)

DUNDAS.

W. H. Gibson manufactures machinists' tools, cracker and biscuit machines, printing presses, copying presses, coffee and sugar mills, and machines for printers and bookbinders.

Mr. G. contemplates the manufacture of malleable hardware in addition to his present business.

John Gartshore, established in eighteen hundred and thirty-eight, manufactures all kinds of saw and grist mill machinery, woolen machinery, oil stills, worms, tanks, steam engines, boilers, burr stones, &c. &c.

The pumping engines in use at the Hamilton Water Works were erected at these works, and are the only ones of the kind in America; they combine the high and low pressure principles. The cast iron bed plates weigh ten tons, the beams thirteen tons, stroke eight feet. Mr. G. is prepared to construct marine engines, having fitted up several vessels.

The average number of men employed is one hundred, at an average wage of one dollar and twenty-five cents per diem. Yearly value of manufactures is $100,000. Possesses shop room and tools for two hundred men, and when busy employs from one hundred to one hundred and fifty men. During a large portion of the year water power drives the machinery, but in the dry season steam is brought into requisition.

W. A. Young & Co. manufactures lasts, trees, treeing machines, toe stretchers, crimps, pegs, crimping machines, &c. Annual value of manufactures $8,000. Mr. Young has improved the Boston improved crimp, by the introduction of rubber where it is desirable to have a pressure that will yield to the thicker portions of the leather being crimped, it thereby preserves the oil in the leather and obviates the liability to tear, which so frequently occurs when the solid metal crimps are used. He has also invented a boot-treeing machine which is very ingenious, combining the principles of the screw and wedge. It seems to be capable of doing the work in a very satisfactory manner. For these inventions Mr. Y. is securing patents.

Mr. Jas. McMicken carries on the paper making, using water power. He manufactures two kinds, viz., news and wrapping papers. Manufactures about eighty tons of each kind in the year. Mr. M.'s printing paper is, I believe, about the best used for newspapers in this country. It is of milky whiteness, and when inked shews the reading very clear. Its peculiar texture enables it to take the ink readily, giving a clear black impression and not the vexatious grey so tiresome to the reader.

The annual value of his manufactures is about $22,000. Messrs. J. Buntin & Co., of Hamilton, have contracted for the produce of this mill.

I visited the cotton factory of Mr. Wright, but on account of the full particulars lately given in the *Journal*, I did not seek further information than the following, viz.: That seamless bags would shortly be manufactured, and probably cloth. The amount of cotton yarn now manufactured is about 70,000 lbs. per annum.

This is certainly a fine establishment, and one of which Dundas has reason to be proud. The proprietor is an affable, courteous Englishman, and one who well knows how to control his factory. Everything has the appearance of the strictest order and cleanliness.

J. Hourigan manufactures chopping axes and edge tools to the yearly value of $10,000, and gained the first prize at the last Provincial Exhibition. Average wages of men one dollar and thirty cents per diem. Trip hammer and stones driven by water power, as also the furnace blasts.

Billington & Forsyth, manufacturers of agricultural implements, stoves, scales, &c. Annual value of manufactures $30,000; number of men employed fifteen; average wage per diem one dollar and twenty-five cents. Have made improvements in the New York reaper and the Ketchum mower. Are confident of their ability to cope with the American manufacturers in their own markets, were there no duty to prevent their exporting.

In this Town the manufacturers enjoy a good water privilege. About one hundred and fifty horse power is in use, and there are still unused privileges that in the aggregate would afford about the same power. It is an admirable locality for manufactories of almost any kind; raw materials can be laid down either by rail or water. It think it would answer to establish here a cabinet factory, lumber could be cheaply laid down, and the manufactured articles could be with equal facility shipped to the eastward by water and westward by the railway. Another advantage would be the cheap rents to the employees, and the cheapness of provisions and fuel.

ANCASTER.

Mr. Crane manufactures shirts, drawers, stockings, and yarns. Employs twelve men, at an average wage of one dollar per diem; consumes

about twenty thousand pounds of cotton and wool of about equal quantities in the year. Has ten families employed out of the mill, seaming.

Manufactures about twenty thousand dollars worth in the year. Imports only cotton.

Water power is used in driving the machines.

Mr. Ellis has a cloth manufactory, and employs about ten persons at an average wage of one dollar per diem. Makes Canadian cloth and flannel. Yearly value twenty thousand dollars. Works driven by water.

BRANTFORD.

Ganson, Waterous & Co., manufacturers of steam engines, portable and stationary threshing machines, clover mills, smut machines, and general mill work. Average number of men employed ninety. Average wage one dollar and twenty-five cents. Consumes about $16,000 worth of iron, steel, coal, &c., in the year. Six men left the U. S. to enter their employ, with their families, numbering thirty persons. About two hundred and fifty persons are depending upon their establishment. The annual value of their manufactures is about $60,000.

P. Goold & Co., manufacture stone-ware, and employ nine men, at an average wage per diem of one dollar and twenty-five cents. Consume about $4,000 worth of clay, wood and salt. Four men left the U. S. to enter their employ, with their families, numbering twenty persons. Yearly value of manufactures twenty thousand dollars.

Are not aware that any clay suitable for the manufacture of their wares exists in Canada, have experimented with Canadian clay and find that they fail in the kiln, melting into a shapeless mass. The clay used is South Amboy, or New Jersey. Import about $3,000 worth per annum.

Wm. Buck, manufacturer of stoves and farming implements, employs forty men, average daily wage one dollar and twenty-five cents; consumes iron, tin, copper, coal, &c., to the yearly value of $16,000. Annual value of manufactures $30,000.

Messrs Butler and Jackson, manufacturers of stoves and plows. Average number of men employed ninety. Daily wage on the average one dollar and twenty-five cents. Annual value of manufactures $50,000.

Brantford possesses a prodigious amount of water power, little of which is used compared with the amount available. About two miles from the town is a paper mill, at which only wrapping paper is made. The building was formerly the saw mill of the late Mr. Beuce, and from it the writer has seen millions of feet of lumber being shipped for the eastern market. A little further down the canal is a new building recently erected by Mr. H. Finyalson, late of St. Jacobs, for the purpose of a woollen cloth manufactory. Two sets of machines will be in operation early in the spring. The premises are calculated for four sets.

There is probably no town in Upper Canada where manufacturers can secure the use of water power so cheaply as in Brantford. Those who have small capital, and who desire to engage in manufacturing, would do well to visit this town. There is no lack of water, a good fall and almost nothing else to do than erect the building, put in wheel machinery and gate, and turn on the water. I ought, perhaps, in justice to state, that in Paris also there exists admirable facilities for water privileges.

LONDON.

Samuel Brown, manufacturer of sewing machines, employs fifteen hands, at an average daily wage of one dollar and thirty cents. Five are from the United States. Turns out about four hundred machines during the year; value $10,000.

Mr. B. claims to have improved the Wheeler & Wilson machines by obviating difficulties which are common to them, viz.: Mr. B. adjusts the bobbin in a separate case, so that when a change in thread is made *it adjusts itself*, rendering alteration by the operation unnecessary. The wearing of the shaft endwise is likewise provided for, so that no derangement in the working of the machine takes place as the shaft wears. The frame is in one casting, and completely covers the working parts, thereby protecting them from dust; every part is, however, of easy access. In the Singer machines made by Mr, Brown, he introduces an adjusting screw to the feed wheel, avoiding the use of a winch, it being set to a nicety while the machine is in motion by a thumb screw.

Murray Anderson manufactures stoves, plows, cultivators, hay rakes, straw cutters, &c. Average number of men employed fifty, at an average daily wage of one dollar and twenty-five cents. Yearly value of manufactures $70,000. The cultivator, straw cutter, hay rake, and potato digger, are his own inventions, and have been patented.

J. & O. McClary, manufacturers of stoves, hollow ware, plows, cultivators, harrows, &c., keep on the average forty peddlers out selling their wares. Annual value of their manufactures $150,000. Collect about $18,000 worth of rags in a year. Manufacture the pressed tin ware.

Spending considerable of the time I was in London (two days) in the search of articles for the Exhibition, I did not get as full particulars as I might have done concerning the amount of manufacturing. Quite a number of establishments I did not visit at all, and consequently they are unnoticed.

In the report of Hamilton, I observe I have not given an account of the Plating Establishment of Messrs. McGivern, Helliwell & Co. Their principal business is in Saddlery and Harness Trimmings, which they manufacture. They import malleable goods and do the plating themselves; but all that their blacksmith can make at home, they have done. They have tried the malleable goods made in Montreal, but they were not suitable, not comparing favourably with the American manufactures. Mr. Gibson of Dundas, who contemplates entering upon the manufacture of such goods, will find good customers in this firm, should he manufacture successfully. Messrs. McG., H. & Co. manufacture of plated goods in the course of a year to the value of five thousand dollars—they plate anything that can be plated, such as spoons, forks, &c., &c. They entered upon this branch of manufacture on account of the heavy tariff on plated goods, the labour being a large item in their manufacture.

I also omitted the Factory of H. M. Melville & Co., who manufacture carriage hubs, spokes, &c., and common household furniture. They have gone into this business on account of the scarcity of building contracts, and having a large Factory and excellent machinery, were loth to have so much invested capital lying idle.

I will forward, as soon as I receive the particulars, an account of the G. W. R. Shops and the Port Dover Woollen Works.

I am, Gentlemen,

With respect, yours, &c.,

Geo. E. Pell.

To the Committee of the
Board of Arts and Manufactures for U. C.

PATENTS OF INVENTION.

Bureau of Agriculture and Statistics, Quebec, 15th January, 1862.

Josiah James, of the Township of Whitchurch, in the County of York, Machinist, "A Superficial Wedge Power."—(Dated 20th April, 1861.)

John Read Philp, of the Town of Cobourg, in the County of Northumberland, Shoemaker, "An improved mode of Lowering Boats from the Davits of Ships."—(Dated 22nd April, 1861.)

Elias Vernon, of the City of Hamilton, in the County of Wentworth, Physician, "An Economical Hot Air Apparatus."—(Dated 30th April, 1861.)

Richard Smith of the Town of Sherbrooke, in the District of St. Francis, Machinist, "An improved Extension Auger."—(Dated 8th May, 1861.)

Richard Smith, of the Town of Sherbrooke, in the District of St. Francis, Machinist, "A new and improved Belt Link."—(Dated 8th May, 1861.)

Laughlin M. Cole, of the City of Montreal, Shoemaker, "A Metallic Heel for Boots and Shoes."—(Dated 8th May, 1861.)

George H. Hinton, of the City of Montreal, Saw Manufacturer, "New and useful improvements in the Manufacture of Saws."—(Dated 8th May, 1861.)

Ashley Hibbard, of the City of Montreal, India Rubber Boot and Shoe Manufacturer, "Ventilating India Rubber Boots and Shoes."—(Dated 11th May, 1861.)

Andrew James Park, of the Village of Norwichville, in the County of Oxford, Physician, "An improved process of Tanning and Manufacturing Leather."—(Dated 20th May, 1861.)

James Stewart, of the City of Hamilton, Iron Founder, "A new and improved Pattern or Design for Cooking Stoves."—(Dated 20th May, 1861.)

John Thomas, of the city of Toronto, in the County of York, Piano Forte Maker, "An improvement in the construction of the Piano Forte."—(Dated 21st May, 1861.)

Heman Hazleton, of the Township of Townsend, in the County of Norfolk, Carpenter, "An improved Self Propelling Gate."(Dated 21st May, 1861.)

Thomas Fogg, of the Town of Brantford, in the County of Brant, Railway Inspector, "A Ballasting Car."—(Dated 21st May, 1861.)

Silas Welte, of the village of Princeton, in the county of Oxford, Cabinet Maker, "An improved Churn, termed the "Blenheim Churn."—(Dated 22nd May, 1861.)

Robert Kerr, of the Township and County of Waterloo, Yeoman, "A Grain and Seed Broad cast Sower."—(Dated 25th May, 1861.)

Thomas Davis, of the village of Marysville, in the township of Wolfe Island and County of Frontenac, Mariner, "A submarine Buoy Purchase."—(Dated 27th May, 1861.)

George A. Carman of the village of Morrisburgh, in the County of Dundas, Carriage Maker, "A Vegetable Root Cutter."—(Dated 28th May, 1861.)

William Cooley, Assignee of E. S. Perkins, both of the City of Montreal, "A new and useful improvement in the ordinary two arm Saw-Set."—(Dated 3rd June, 1861.)

Michael Clair, of the Township of Sophiasburg, in the County of Prince Edward, "The Excelsior Washer."—(Dated 4th June, 1861.)

James McKelvey, of the Town of St. Catharines, in the County of Lincoln, Tinsmith, "A Refrigerator termed the 'Prince of Wales Cupboard Refrigerator."—(Dated 25th June, 1861.)

Adam Young, of the Township of Crowland, in the County of Welland, Yeoman, "An improved Mill Saw."—(Dated 9th July, 1861.)

James Dolby and Isaac Dolby, both of the Township and County of York, Farmers, "A new and improved Lath Cutting Machine."—(Dated 17th July, 1861.)

John Patterson, of the Village of Ingersoll, in the County of Oxford, Saloon Keeper, "A Drill for drilling holes in rock."—(Dated 17th July, 1861.)

David Bruce, of the City of London, in the County of Middlesex, Machinist, "An improved Sawing Machine."—(Dated 17th July, 1861.)

Elias Vanderwater, of the Township of Sidney, in the County of Hastings, Machinist, "An improved Reaping and Mowing Machine."—(Dated 17th July, 1861.)

Abimelech Hillman, of Stratford, in the County of Perth, Cabinet Maker, "A Spring Cushioned Seat for Waggons and other Vehicles."—(Dated 17th July. 1861.)

Henry Fryatt, of Aurora, in the County of York, Carpenter, "Rotary Tooth for Harrows."—(Dated 17th July, 1861.)

James Hilborn of the Township of Reach, in the County of Ontario, Millwright, "A Steam Locomotive for travelling upon public highways."—(Dated 17th July, 1861.

George Deans, of the Town of Port Dover, in the county of Norfolk, Mechanic, "A Challenge Washing Machine."—(Dated 18th July, 1861.

Almas A. Knowlton, of the Township of Brome, in the County of Brome, "A Washing Machine."—(Dated 18th July, 1861.)

John Pike, of Prescott, in the County of Grenville, as assignee of John G. Fraser, of the aforesaid place, Barber, "An improved Churn."—(Dated 30th July, 1861.)

Charles R. Parkes, of the City of Toronto, in the County of York, Turner, "An improved Churn."—(Dated 30th July, 1861.)

Peter McEwen, of Russell, in the County of Russell, Farmer, "An improved Plough."—Dated 30th July, 1861.)

Abiel O'Dell, of the Town of Bowmanville, in the County of Durham, Machinist and Builder, "A Self-regulating Spiral Spring Mangle and Washing Machine."—(Dated 3rd August, 1861.)

John Powers, of the Town of Stratford, in the County of Perth, Builder, "The Victoria Washing Machine."—(Dated 3rd August, 1861.)

Richard H. Oates, of the City of Toronto, in the County of York, Manufacturer, "A Self-revolving wind Mill House with circular foundations."—(Dated 9th August, 1861.)

Paul Taylor Ware, of the City of Toronto, in the County of York, Sewing Machine Agent, Assignee of John A. Cull and Edward L. Cull, both of the same City, "An improved Sewing Machine."—(Dated 9th August, 1861.)

David Elm Norton, of the Town of Bowmanville, in the County of Durham, Machinist, "An improved Churn, termed "Norton's Horizontal Screw Dash Churn."—(Dated 10th August, 1861)

Alfred Bigelow, of the City of Hamilton, in the County of Wentworth, Merchant, "A new and improved Rock Drill."—(Dated 10th August, 1861.)

Samuel Slater, of London, in the County of Middlesex, Boot-Maker "An adjusting Last."—(Dated 20th August, 1861.)

Andrew Whytock, of the City of Quebec, Manufacturer of Galvanized Iron, "Improvements in Coating Sheets of Metal with other metals and other substances."—(Dated 27th August, 1861.)

Jedediah Hubbell Dorwin, of the City of Montreal, Gentleman, "An improved Mercurial Barometer." —(Dated 18th September, 1861.)

Robert Webber, of the Township of East Zorra, in the County of Oxford, Yeoman, "Webber's Scarifier or Field Cultivator."—(Dated 20th September, 1861.)

William and Thomas Walker, both of the Township of Chinguacousy, in the County of Peel, Carpenters, "The Ocean Wave Washing Machine."—(Dated 29th November, 1861.)

C. S. Shannon, of the City of Hamilton, "An improved Driving Rein."—(Dated 20th November, 1861.)—

Henry Dodd, of the Township of Goderich, in the County of Huron, "Improved Sieves or Screens for Fanning Mills."—(Dated 29th November, 1861.)

Volney O'Brien, of the Town of Guelph, in the County of Wellington, "The Excelsior Churn."—(Dated 29th November, 1861.)

Amos Bowerman, of the Township of Whitchurch, County of York, Yeoman, Jacob C. and Willis D. Bowerman, both of the Township of Whitby, in the County of Ontario, Clothiers, "Bowerman's improved Carding Machine."—(Dated 29th November, 1861."

James G. Thompson, of the Town of Peterborough, Gentleman, "An Automatic Gate."—(Dated 29th November, 1861.)

Asa Jarvis Foote, of the Village of Tilsonburg, in the County of Oxford, "A new and useful Washing and Scouring Machine."—(Dated 29th November, 1861.)

Hugh McLaren, of Lowville, in the County of Halton, "A combined Seed Drill and Cultivator." —(Dated 29th November, 1861.

Thomas McIlroy, of Brampton, "An improved invalid Bedstead."—(Dated 29th November, 1861.)

N. H. Nutting, of the Township of Marysburg, in the County of Prince Edward, "The Ontario Washing Machine."—(Dated 29th November, 1861.)

William Depew, of Paris, County of Brant, Tinsmith, "A balance Gate."—(Dated 29th November, 1861.)

Edward Smith, of the Township of Edwardsburg, in the County of Grenville, Yeoman, "Egyptian Gas."—(Dated 29th November, 1861.)

We purpose publishing in each number of the Journal a selection from the London *Mechanics' Magazine* (a valuable periodical, with but limited circulation in this country) of abridged specifications of such English patents as may be deemed useful or interesting to our Canadian readers.

Full specifications of all English patents issued may be obtained on application to Bennet Woodcroft, Esq., Great Seal Patent Office, 25 Southampton Buildings, Holborn, London; the price of which—varying from 3d. to 5s. sterling—must be remitted by Post Office order, made payable at the Post Office, Holborn.

Lists of all specifications may be seen at the Free Library of Reference of the Board of Arts and Manufactures, Toronto, as published in the Commissioner of Patents Journal.

We shall use our best endeavors to obtain for publication abridged specifications of patents issued in Canada, so as to make this department of our Journal as interesting as possible to Canadian manufacturers and inventors.

ABRIDGED SPECIFICATIONS OF ENGLISH PATENTS.

1123. W. Rowan. *Improvements in machinery for scutching flax and other fibrous substances, appli-*

cable also for reducing flax, hemp and other fibrous materials into tow. Dated May 6, 1861.

This invention consists in scutching flax, hemp and other fibrous materials, by means of a revolving cylinder fixed in a frame, round which cylinder are placed combs and beaters, and to which the flax or other fibrous material is pressed by the hand through an opening provided for the purpose in front of the machine. After having been sufficiently acted on the flax is withdrawn and reversed end for end ; this done, it is then put through the same operation, when it is finished. The patentee sometimes uses rollers to pass the flax or hemp into the machine. When hemp, flax or other fibrous material is to be reduced into tow, he then places round the cylinder by preference five combs or heckles. *Patent completed.*

(This machine is highly recommended by some leading flax manufacturers of Belfast, Ireland, as a useful invention.—Ed. Journal.)

1144. W. E. Newton. *An improved lubricating compound.* (A communication.) Dated May 6, 1861.

This consists in the preparation of a composition obtained by uniting an alkaline base, such as potash or soda, with oleine or stearine (the proximate acid principles of animal and vegetable oils, fats and tallow,) and wth erine (the acid principle of wax). *Patent completed.*

1170. H. Swan. *Improvements in lubricating apparatus for lubricating the journals and bearings of shafts and other frictional surfaces of machinery.* Dated May 8, 1861.

The patentee claims the use and application of lubricators having measuring delivery cups in which the capacity of the cup can be regulated and adjusted to the capacity of the bearing or part to be lubricated as described. Also the arrangement by which the oil passes from a measuring and delivery cup through its hollow supporting arm and is delivered as described. *Patent completed.*

1186. L. W. Roddewig. *Improvements in steam boilers.* (A communication.) Dated May 10, 1861.

This consists in the construction of boilers with an inner and an outer chamber, the inner chamber being in more immediate contact with the head of the furnace, and is surrounded with the outer chamber, the water level in the inner chamber being considerably higher than usual. There is a pipe communicating from the upper part of the outer chamber to the lower part of the inner chamber, through which the water passes from the former to the latter, when it has attained a sufficiently high level in the former. By this arrangement, the water being fed into the outer chamber is made to circulate around the inner chamber, in a direction contrary to that in which the heat passes along the flue around the outer chamber from the furnace to the chimney. By this arrangement, also, the sediment is caused to be collected in that part of the chamber which does not come in contact with the flue. *Patent completed.*

1195. J. Wareing. *Improvements applicable to Ryder's forging machine, which render it better adapted for forging mule spindles and articles of similar form.* Dated May 11, 1861.

This consists in making the acting forces of the swages or hammers narrow in the direction of the length, but broad or long in the direction across the rod or bar operated upon, and in forming and arranging them so that the space between the two faces at one side will be wide enough to admit the largest part of the intended taper, the space gradually diminishing to the other side, where the space between the faces is only sufficient to admit the smallest part of the intended taper. *Patent completed.*

1214. T. Bell. *Improvements in the decomposition of the compounds of aluminium, and in coating metals with aluminium or its alloys.* (A communication.) Dated May 13, 1861.

This consists in effecting the decomposition of the compounds of aluminium (for instance, the double chloride of aluminium and sodium) by the agency of galvanic electricity, and also in coating metals with aluminium by the same agency. By this process the patentee converts the surface of copper (for instance) into aluminium bronze. *Patene completed.*

1223. W. Clark. *Improvements in the manufacture of steel.* (A communication.) Dated May 14, 1861.

The patentee claims the simultaneous purification and conversion of iron by calcining it in the presence of coal or other hydrogenous or azoted matter, in combination with a carbonate, alkali or other subtances capable of absorbing sulphuretted hydrogen. *Patent completed.*

1228. R. A. Brooman. *Improvements in working sugar refineries, and in sugar moulds and apparatus for trimming the loaves therein.* (A commuication.) Dated May 14, 1861.

This invention consists in placing the pan or copper, from which the sugar for filling the moulds is to be taken, at the bottom or lower floor of the building, in forming the building with a shaft fitted at top with a hoisting and lowering apparatus, and communicating with each of the floors in which the moulds to be filled are kept. The pan is fitted with a valve commanding an outlet pipe in the bottom thereof, from which the sugar is run into a jacketted filling pot, formed by preference with a spout and fitted with a cover. The filling pot, after being charged, is run upon a truck into the shaft and hoisted to one or other of the floors where the moulds to be filled are placed ; it is then put upon another truck, and is suspended from a tackle and blocks in such a manner that it may be tilted and the contents poured into the moulds. The moulds are formed at bottom with an aperture, which is threaded, and which is closed by a pointed metal spile which rises a slight distance inside the mould, and forms a hole in the head of the loaf of sugar ; the spile terminates inside the mould in a button, on which a washer rests to make a tight joint. The moulds with the spiles screwed in are held in frames constructed of wood, with apertures for the moulds to be supported in. Double lines of rails are laid on each floor, and the frames with the moulds are run about for the purpose of filling, and otherwise in carriages on them. Water cans are also provided, and these, being filled, are wheeled in the carriages to the moulds, for the purpose of their being washed, so that they need not be taken from the particular floor on which they are placed ; spouts for carrying off the water after having been

used are provided for each floor. For the purpose of trimming the base of the sugar loaf, a dome shaped frame is placed over the mould, which frame carries on the end of a spindle, cutters or scrapers, which, on being rotated, make the base of the sugar loaf even, and at the same time give a bevel edge thereto. *Patent completed.*

1243. W. Jackson. *Improvements in mortising machines.* Dated May 15, 1861.

This invention consists in connecting the hand lever of a mortising machine to the apparatus which carries the cutting tool, by means of a link, so as to produce the required vertical motion of the cutter or chisel. The spindle to which the cutting tool is fixed passes through an upright casing or box or cylinder fixed upon the spindle. These two parts move together vertically, but the spindle has an independent axle motion, so that the position of the cutter may be altered when required. Into the casing, box, or cylinder, a pin which is connected to the upper part of a pendant link enters at the side and has a free motion within it. At the lower end of the link is another pin which enters into and has a free motion within the hand lever. The hand lever moves vertically to actuate the cutter or chisel, and is connected to the framing of the machine by a pin or stud which cuts as a fulcrum. When, therefore, the hand lever is raised or lowered, a corresponding motion is communicated by means of the link to the casing, box, or cylinder, and consequently, to the spindle which carries the cutter. The cutting operation is therefore effected by bringing down the chisel by means of the hand lever, and the wood under operation may be moved forward as required by means of the toothed gearing connected with the moveable bed on which the wood is secured. *Patent completed.*

INKS.

Printing Ink.—1 (Very fine.)—Balsam of capaivi, 9 parts ; fine lamp-black 4 parts ; indigo 1 part; dry yellow soap 3 parts. Grind perfectly smooth.

2. (Extemporaneous.)—Balsam of capaivi, lampblack to color. Grind well together with a little soap.

3. Take linseed oil ; heat in a proper vessel until it begins to boil, then remove it from the fire, and kindle the vapour ; allow it to burn till it becomes stringy when tried between the fingers, then add gradually to every quart black resin 1 pound. Dissolve, and add very cautiously dry brown soap in shavings, 4½ ounces to every quart. Set it upon the fire, and stir the mixture until the combination is complete ; next, put into a suitable pot, finely ground indigo 1 ounce ; fine Prussian blue 1 1 ounce ; fine lamp-black 18 ounces. For every pound of resin employed pour the liquid on the color, well mix, and lastly, subject it to the action of a mill.

To give an appearance of Age to Writing.—Infuse a drachm of saffron in a half pint of ink, then write with it.

Perpetual Ink for Tombstones, Marble, &c.—Pitch 11 parts ; lamp-black 1 part ; turpentine sufficient. Mix with heat.

Blue Ink.—Take sulphate of Indigo, dilute it with water till it produces the color required. It is with sulphate very largely diluted, that the faint blue lines of ledgers and other account books are ruled. If the ink were used strong, it would be necessary to add chalk to it to neutralize the acid. The sulphate of indigo may be had of the woolen dyers.

BOOKS ADDED TO THE FREE LIBRARY OF THE BOARD DURING THE MONTH.

CLASS II.

Antiquities of England, 4to plates.. *Anon.*

CLASS III.

Plans and Elevations for Public and Private Buildings, 2 vols. in one, folio, 1770......... *Inigo Jones.*
Architectural Plans and Elevations from original Designs, 2 vols. folio, 1756........... *Isaac Ware.*

CLASS V.

Catalogue of International Exhibition of 1851, 1 vol. folio.................................. *Art Union.*

CLASS VI.

Vases and Ornaments, designed for the use of Architects, Silversmiths, Jewellers, Modellers, Chasers, Die Sinkers, Founders, Carvers, and all Ornamental Manufactures, 1 vol., 1833 .... *Knight.*
Art Union Illustrated Exhibition Catalogue, 1 vol., 1861.................................... *Geo. Virtue.*

CLASS VII.

Dictionary of Chemistry, Arts and Manufactures, 2 vols., Imp. qu. 1860.................. *Dr. Muspratt.*

CLASS XIV.

Chemistry as applied and relating to Arts and Manufactures, 2 vols., Imp. qu. 1860... *Dr. Muspratt.*

CLASS XVII.

Naval and Mail Steamers of the United States, 1 vol., folio 1853............................. *Chas. B. Stuart.*

BRITISH PUBLICATIONS FOR DECEMBER, 1861.

	£	s.	d.	
Adcock's Engineer's Pocket-Book for 1862	£0	6	0	*Simpkin.*
Alison (Sir A.) Lives of Lord Castlereagh and Sir Charles Stuart, 3 vols. 8vo	2	2	0	*Blackwoods.*
Anderson (Rev. James) Memorable Women of the Puritan Times, 2 vols. cr. 8vo	0	12	0	*Blackie.*
Baker (Charles) Circle of knowledge, a Scientific Class-Book, Gradation 4, fcap. 8vo	0	4	0	*Wertheim.*
Ballantyne (R. M.) Gorilla Hunters, a Tale of the Wilds of Africa, fcap. 8vo	0	5	0	*Nelson.*
Bannatyne (G. M.) Guide to Examinations for Promotion in Infantry, Part 1, cr. 8vo	0	5	0	*Smith & Elder.*
Beever (Rev. W. Holt) Notes on Fields and Cattle, post 8vo	0	8	6	*Chapman & H.*
Bohn's English Gentleman's Library, Walpole's Letters, V. 9, 8vo	0	9	0	*Bohn.*
——— Philological Lib., Lowndes' Bibliographer's Manual, by Bohn, V. 4. Part 1 post 8vo	0	3	6	*Bohn.*
Bradley (Thomas) Elements of Geometrical Drawing, part 1 fol	0	16	0	*Chapman & H.*
Braithwaite's Retrospect of Medicine, Vol. 44, July—Dec., 1861, post 8vo	0	6	0	*Simpkin.*
British Workman (The). 1855—1861. 1 vol. fol	0	12	0	*Partridge.*
Buckle (Henry Thomas) History of Civilization in England, V. 1, 3rd edit, 8vo	1	1	0	*Parker & Son.*
Bucknill (John C.) and Luke (Daniel H.) Manual of Psychological Medicine, 2nd ed. 8vo	0	15	0	*Churchill.*
Builders' (The) and Contractor's Price-Book for 1862, 12mo	0	4	0	*Lockwood.*
Carmichael (Peter) Science of Music Simplified, roy. 8vo, red. to 1s. sd	0	1	6	*Simpkin.*
Carter (Thomas) Medals of the British Army. Div. 3. India, China, &c., 8vo	0	7	6	*Groombridge.*
Cassel's Illust. History of England during last 100 years, by W. Howitt, V. 2, imp. 8vo	0	6	0	*Cassell.*
Catalogue of MSS. in the Library of the University of Cambridge, V. 4, 8vo	1	0	0	*Cox.*
Chambers (George F.) Hand-Book of Descriptive and Practical Astronomy, post 8vo.	0	12	0	*Murray.*
——— Enclyopedia, a Dictionary of Useful Knowledge, V. 3, sup.-roy. 8vo	0	9	0	*Chambers.*
Copleston (Mrs. Edward) Canada: Why we Live in it, and Why we like in, fcap. 8vo	0	2	6	*Parker & Son.*
Couch (Jonathan) History of the Fishes of the British Islands, V. 1, roy. 8vo	0	17	0	*Groombridge.*
Culsha (Rev. Edward Widt) Eastern Lands and Eastern People, post 8vo	0	6	6	*Marlborough.*
Drew (Rev. W. H.) Solutions to Problems contained in Conic Sections, cr. 8vo	0	3	6	*Macmillan.*
Dumas (Alexandre) Historical Library: Black Tulip (Rosa), fcap. 8vo	0	2	0	*C. H. Clarke.*
Edwards (Rev. L. C.) Formulæ in Pure and Mixed Mathematics, fcap. 8vo	0	3	0	*Harrison.*
Hodgson (C. Pemberton) Residence at Nagasaki and Hakodate in 1859–60, cr. 8vo	0	10	0	*Bentley.*
Hollingshead (John) Underground London, 12mo	0	2	6	*Groombridge.*
Hullah (John) History of Modern Music, a Course of Lectures, cr. 8vo	0	6	6	*Parker & Son.*
Hunt's Yachting Magazine, Vol. 10, 1861, 8vo	0	14	0	*Hunt.*
Jones (Thos. Rymer) Outline of Organization of the Animal Kingdom, 3rd edit., 8vo	1	11	0	*Van Voorst.*
Kirby (Mary and Elizabeth) Plants of the Land and Water, 18mo, red. to	0	2	6	*Jarrold.*
——— Things in the Forest, fcap. 8vo	0	2	0	*Nelson.*
Levy (Matthias) History of Shorthand Writing, post 8vo	0	5	0	*Trubner.*
——— Poets and Prose Writers of France, with Biog. Notices, cr. 8vo	0	7	6	*Black.*
Millington (Ellen J.) Heraldry in History, Poetry and Romance, post 8vo, red. to	0	5	6	*Bickers & Bush.*
Pepper (John H.) Boy's Playbook of Science, new edit., cr. 8vo	0	6	0	*Routledge.*
Percy (John) Metallurgy; the Art of Extracting Metals from their ores, 8vo	1	1	0	*Murray.*
Petachia (Rabbi) Travels in Poland, Russia, Little Tartary, the Crimea, &c., post 8vo	0	5	0	*Longman.*
Pitman's Popular Lecturer, Vol. 6, 1861, fcap. 8vo	0	2	6	*Pitman.*
Rogers (Mary Eliza) Domestic Life in Palestine, post 8vo	0	10	6	*Bell & Daldy.*
Scott's Practical Cotton Spinner and Manufacturer, 5th edit., 8vo	0	11	0	*Simpkin.*
Transactions of the Linnean Society of London, Vol. 23, part 2	1	4	0	*Longman.*
Turner's Liber Studiorum, Photographs from the 30 Original Drawings, roy. folio	0	3	6	*Cundall & D.*
United States (The) and Canada, as seen by Two Brothers in 1858 and 1861, cr. 8vo	0	4	0	*Stanford.*
Vandenhoff (George) Art of Elocution, with Extracts, 3rd edit., fcap. 8vo	0	5	0	*Low.*
Westgarth (William) Australia: its Rise, Progress, and Present Condition, fcap 8vo	0	3	6	*Black.*

AMERICAN PUBLICATIONS FOR JANUARY.

	$	c.	
Craighill—The Officer's Pocket Companion, principally designed for Staff Officers in the Field. Partly translated from the French of M. de Rouvre, Lieut. Colonel of the French Staff Corps, with Additions from Standard American, French, and English Authorities. By William P. Craighill, First Lieut. U. S. Corps of Engineers, Assistant Professor of Engineering at the U. S. Military Academy. 18mo. pp. 314	1	50	*D. Van Nostrand*
Hallam—Constitutional History of England from the Accession of Henry VII. to the Death of George II. 3 vols. 12mo	3	75	*Crosby & Nichols*
Irving—Chronicle of the Conquest of Granada. From the MSS. of Fray Antonio Agapida. By Washington Irving. Author's revised edition. 12 mo. pp. 548			*G. P. Putnam.*
Jomini—The Political and Military History of the Campaign of Waterloo. Translated from the French of General Baron de Jomini, by Capt. S. V. Benet, Ordnance Department, U. S. Army. Second edition, 12mo. pp. 327	0	75	*D. Van Nostrand*
May—The Constitutional History of England since the Accession of George III., 1760—1860. By Thomas Erskine May, C. B. In 2 vols. 12mo. Vol. 1. pp. 484	1	25	*Crosby & Nichols*
Stevens—The History of the Religious Movement of the Eighteenth Century, called Methodism, considered in its different denominational Forms and relations to British and American Protestantism. By Abel Stevens, LL.D. Vol. 3. From the death of Wesley to the Centenary Jubilee of Methodism. 12mo. pp. 524	1	00	*Carlton & Porter*

Selected Articles.

FLAX CULTURE IN CANADA.

(*Continued from page* 23.)

The mode of treating the crop in the best manner is practised about Courtrai, and the neighbouring district, and has hence received the name of the

Courtrai System.

This system is to dry the flax after pulling in the field, and to stack it up till the following spring. when it is considered fit for steeping. To ensure the preservation of the seed, which is required for sowing rather than feeding purposes, the straw is put in stooks, care being taken not to tie it into beets or sheaves, but to leave it in small wind-stacks in the field, These wind-stacks are placed on cradles, to keep them off the ground, and to secure them from vermin and damp; the seed-ends are placed in alternate layers, and the bulk comprises from four to six sheaves in height and from three to four in width, the whole being thatched with straw like a sloping roof. When perfectly dry, the crop of flax is stacked up in the field, or farm-yard, like ordinary grain; and if well gathered it is considered to be improved by three years' keeping, as it will scutch much easier and to more profits.

Rippling.

The Belgians carefully attend to the rippling of the flax, because they consider it handles much easier afterwards, and that the seed is the most valuable part of the crop. For speedy work, three ripples are applied to an acre of pulled flax in a day; they are placed in the middle of the field, on a winnowing cloth, and if a cloth is not at hand, the ground upon which the machine stands is cleaned and beaten until it is as hard as a barn-floor. Six men require two women, two children, and a horse and cart to bring forward the straw, to ripple an acre of flax daily; the ripplers are kept stationary, in order that they should loose no time, but do their work well, which is not always the case, if they are interrupted by moving about. The girls supply the ripplers with the untied flax, and carry off the straw, when rippled, to the female binders, who are placed on each side the ripple, and are capable of tying a bundle of fourteen inches span, which size is best adapted for steeping. The best ripplers invariably sit down, and keep both elbows closer to their sides, to lighten the labour; this position enables them to give the weight of the body, to assist the arms in pulling through the straw.

The bolls rippled off each day are passed through a coarse riddle or fan, then spread open in the field, either on the winnowing cloth, or on that portion of the ground beaten hard. A girl or boy then keeps continually moving, or rather shuffling through the flax-bolls, with bare feet. At night, or in moist weather, the bolls are raked into ridges, and covered with the weeds gathered from the combs, or with straw; in the morning they are spread out again. If the weather be wet, the bolls are taken in-doors; and if dried at a corn-kiln, the temperature is never raised above summer heat, as it is only by slow drying that the seed can imbibe all the juices from the husks, which is necessary for good ripening. The kiln, however, is avoided if possible. When dry the seed is generally thrashed out with common flails, and cleaned through fans; in this condition it is fit for crushing, when the heaviest and plumpest are picked out for sowing. The value of the seed, like that of the fibre, is, however, greatly dependant upon the proper saving of the straw.

The Courtrai flax is produced not merely from the plant grown about Courtrai, but from what is carted to that place from other districts of Belgium, many of them thirty or forty miles distant. The reason of this is, that the river Lys, which rises on the other side of the French frontier, flows by Courtrai, and falls into the Escaut at Ghent, possesses peculiar properties for the fermentation of flax, such as no other river is known to afford. It is found that flax straw steeped in this famous stream yields a fibre of a very superior quality to that which is steeped anywhere else; and as Courtrai is the chief seat of operations, all the flax steeped in the Lys is termed Courtrai flax, wherever may the locality of its growth.

There are several modes of steeping, or what may be termed rotting, the flax. The object is to separate the fibre from the woody and gummy portions of the straw, and this is generally done by cold-water fermentation. Sometimes it is effected by what is called dew-rotting, that is, the straw is left upon the grass; sometimes it is rotted stagnant, and at others in running, water. In Belgium there are persons employed as regular steepers of flax; and when the farmer sells his crop of flax, before it is dressed, to the merchant or manufacturer, these persons dress and prepare it for the market. There are two or three modes of steeping even at Courtrai. One party make an artificial basin on the side of the river, of sufficient size to contain the flax, in which it remains until steeped; proper care being taken to keep it in an upright position with the roots downwards, for which purpose it is placed in a kind of hurdle or basket. In the majority of cases, however, the flax is steeped in the open stream; and those who have chanced to visit the banks of the Lys in the months of Spring and Autumn, must have frequently seen it filled with wooden crates, containing flax straw, and anchored in the stream.

In other cases, a pool or cistern of water is formed in the field, in which the flax is immersed, fixed upright, and the ends of the plants are not allowed to touch the bottom of the cistern; the latter is so arranged that the water can be drawn off and renewed at pleasure, as the flax is considered to have more weight when cleaned in this way than by any other, which necessarily augments its value.

Great skill is required to determine the precise time when the process of rotting is completed, and the flax should be removed from the water, as a few hours frequently makes a difference in its colour. The ordinary time, however, is from eight to ten days, according to the weather; but it clearly depends upon observation and experience—care being taken in all cases that the water has no mineral substance in it, which would in all probability discolour the fibre.

The steeping of the flax has no doubt been suggested by the constituent properties of the plant. If we examine the fibre with a microscape, its

structure will be found to consist mainly of three parts. First, there is the straw; secondly, there are bundles of capillary filaments running parallel to each other, and lying upon the straw; and thirdly, the outer rind, too frequently taken for the fibrous portion of the matter, called the cuticle. The cuticle, or rind, is composed of a resinous or gummy substance, which is nearly insoluble in cold water; but when heated to a proper temperature, easily separates from the other constituents of the plant. For this reason, all judicious steepers avoid putting their flax in spring water, or even in water sheltered from the sun's rays, because the object of steeping is to dissolve, or at least to soften the cuticle, and thereby allow the filaments to be separated from it. If it does not arrive at this state, the rind, becomes hard in the course of drying, and prevents the separation which is necessary to produce fine flax.

The breaking and scutching operations are done both by hand and by machinery. Among the small growers the hand is more commonly used than the machine. The two processes are conducted after the following manner:—A block of wood, about five or six feet in length, by ten or twelve inches in width, having deep groves extend- through its entire length, about an inch wide at bottom, and increasing in width, in order that the surface of each groove may present a sharper edge, forms the lower portion of the hand-break. Over this block of wood another is fitted, having one end made fast with a hinge, and the other shaped like a handle. This upper block has two longitudinal edges, shaped to fit in the grooves of the under part of the implement; the flax-breaker, taking in his left hand a quantity of flax, and holding the handle with the right hand, places it between the two surfaces of the break, which, being repeatedly raised and let down with considerable force, breaks the stem without injuring the fibres, and separates the latter from the woody particles andother extraneous matter.

The next operation is separate the fibres from the *shoves*. or woody particles, which is ordinarily performed by a scutching-bat and a scutching-board. The board is fixed firm and upright in the stand, and the handsful of flax are inserted in the notch, held in the left hand, and placed so as to project towards the right, when it is beaten with the scutcher several times against the upright board; the portion in the notch being continually changed with the left hand.

In the larger establishments, however, where more concentrated labour is required for the process of scutching, machinery is commonly used. This machinery, in general, does its work in a very effective and rapid manner; yet there is still a lingering prejudice in favour of hand labour, and of the productions of that labour, amongst several classes of the community.

The mill, in general requisition, is sometimes driven by horse-power, but where available by water-power. There are three fluted cylinders—one of which is made to revolve by the power mentioned, and carries the other two round. The flax is placed between these cylinders while revolving, and the stalk by this operation is completely broken, without injuring the fibre. The scutching is performed in the same machine, by means of four arms projecting from a horizontal axle, arranged so as to strike the stalk in a slanting direction, by means of which the outer cuticle and other extraneous matter are removed.

The crops of flax in Belgium, when reared upon the system we have just described, realize almost fabulous prices. From £40 to £60 per acre is an ordinary return; and for the finest quality of flax, from £80 to £100 per acre has been obtained. The export of flax fibre to France and England is, in fact, one of the chief resources of the little state of Belgium, and it averages nearly one million sterling per annum in value. Leeds and Belfast, especially the former, are the best customers for this fine fibre; and the higher numbers of yarn—those from one hundred and sixty leas (fifteen hanks to the lb.) and upwards—are most exclusively spun from Belgian flax. Some of the Leeds and Belfast spinners have their buyers in the Belgian market, with full authority to purchase on their account, and to select the qualities they may require for the mills at home.

The fineness and excellence of the Belgian flax may, however, be better understood by perusing the following facts:—In the contributions to the Dublin Exhibition, we remarked those of Messrs. Collings, Freres and Co., of Courtrai, and M. P. J. Verbeck, of East Flanders, and Baptiste Van Weil, of Grembargen, near Termonde. These specimens of flax we examined with the best attention we could command, aided by perhaps the highest practical experience in Ireland, and never saw anything to equal them for fineness, softness, and lustre, combined with neatness of handling. The series we examined included three samples from Lokeren, in the Pays De Waes, all of beautiful quality, some white and blue Bruges, and three fine specimens of Courtrai. Few of these qualities were worth less than £70 per ton; and some of them run as high as £150; while the finest of all was estimated at £200 per ton. But even this high price is considerably outdone by the fibre from which the Mechlin and Brussels lace is made, as it has been known to sell for £4 per pound weight, when hackled, or nearly £9,000 per ton! Yet, in this extreme case, so little does the value of the material enter into that of the exquisitely fine and tasteful product, that a lace handkerchief, weighing about two ounces, has been known to sell for 2,500 francs, or £100.

The Importation and Exportation of Flax.

It may not be superfluous to furnish the proportional quantities of flax supplied by each continental state. The return is for 1850, which will convey a pretty clear idea of the nature and and extent of our annual demands, upon the foreign grower; there is no statement published of a later date.

Imports of Flax and Tow, or Codilla or Flax and Hemp, into Great Britain and Ireland, for the year 1850.

From	Cwts.
Russia*	1,240,766
Prussia	263,271
Holland	133,240
Belgium	107,336

* The following note on the flax trade of Russia will, perhaps, be read with interest at the present moment. From a statistical report of M. Tegoborski, Privy-councillor to the Emperor, we learn these facts:—M. T. estimates the average annual value of the Russian flax and hemp crops at 36,523,000 *silver roubles*, or about

Egypt	46,505
Hanseatic Towns	20,593
France	3,374
Denmark	2,958
Hanover	2,452
Tuscany	713
Australia	81
Sardinia	58
Malta and Gozo	55
United States of America	30
West Indies	8
Channel Islands (for. flax)	2
Total	1,822,918

The relative importance of flax-cultivation and its subsequent conversions, in each country of Europe, may be seen by the following imports:—

Great Britain and Ireland imported, in 1851	59,709	£2,985,450
France	18,563	932,106
The Zollverein States	11,882	494,000
Belgium	4,562	260,600
Total imported by the four countries	94,716	£4,772,156

In round numbers, therefore, the United Kingdom annually works up of foreign flax, the value of £3,000,000, while the other three States' aggregate consumption amounts to £1,750,000: of this quantity, Russia, it will be seen, furnishes by far the largest portion.

The Exportation of Flax.

Belgium takes precedence as a flax-exporting country, and her largest customers are the United Kingdom and France. The latter country generally consumes from fifty to one hundred per cent. more of Belgian flax than we do, as she requires the finest quality of material for her exceptional kind of goods. The quantity, however, of the French and our own importations, were nearly equal, in 1851; the one amounting to 5,656 tons against 5,290 tons, Other countries took about 123 tons of the Belgian flax; while the value of the exports from the United Kingdom amounted to £172,866:—

The Zollvereign States exported, in 1851	10,530	£502,650
Belgium	9,127	571,960
Great Britain and Ireland	4,979	172,866
France	777	41,724
Making the total export of flax from the four countries	24,813	£1,289,200

£5,847,680. This is exclusive of the Asiatic Provinces, in which, however, little is produced. With reference to the manufacture of linen, M. T remarks:—"The material for a web of 2,600 threads, costs, in the government Jaraslow, thirty to forty per cent. dearer than in Belgium. For a web of 3,400 threads, the difference is sixty per cent.; and for a web of 4 200 threads, it is sixty-eight to one hundred and ten per cent The difference increases with the fineness of the fabric, and this difference arises from the cost of labour. Besides the greater cost of hand-spinning over the spinning by machinery, the Russian weavers are paid precisely double the Belgian weavers, while the latter work better and speedier."

EXTRACTS

FROM THE ADDRESS OF THE CHAIRMAN OF THE SOCIETY OF ARTS, NOV. 30, 1861.

Mosaic Art.

The simplest form of Mosaic, or what may be regarded as closely allied to that art, is the encaustic tile, which is said to have been in universal use in England from 1300 to 1500, but was not again revived until 1830, when a patent was obtained for the preparation of encaustic tiles, with which the name of Minton has been generally associated, and which have been extensively made by many manufacturers of pottery. The second stage in the revival of the art of mosaic was the invention of Mr. Singer, who sought to produce a perfect imitation of the ancient tessilated pavement of the Romans, by the employment of a very ingenious machine for producing clay properly manipulated in the form of tesseræ, or small cubes, uniform in size, colour, surface, and hardness, and which were burnt and partially vitrified. The third stage in the revival was the discovery, by Mr. Prosser, of Birmingham, in 1840, of an improvement which carried one branch of the art to a high point of perfection, and which consisted in subjecting china clay, when reduced to a dry powder, to strong pressure between steel dies, whereby it was converted into a compact substance of much hardness and density, less porous and much harder than porcelain uncompressed and baked in the furnace. This discovery was applied by Mr. Prosser to the to the production of shirt buttons, and has also been extensively employed for this purpose in France, but was employed by Mr. Blashfield in the formation of tesseræ, made for him by Minton, and used with much success in many large works, one of his earliest specimens being the pavement of the hall of this Society, which was jointly presented by Messrs. Blashfield and Minton.

May we not adopt the concluding passages of Mr. Wyatt's paper, and say that the noblest works of antiquity derive much of their beauty from form, much from carving, much from colour, but more from the perfection of industrial arts employed in their construction; and happy it is for this Society to be regarded as the nursing mother of such arts. The applicability of mosaic, as an essential element of decoration, can scarcely need argument. "Its glowing colours would revive our drooping taste for the rich and ornamental, and its imperishability would serve to perpetuate the fact that England once possessed and cherished a decorative art somewhat more enduring than compo."

Programme of Examinations.

The Society's programme of Examinations for 1862, has been published and widely circulated, and supplies ample details for the guidance of Local Educational Boards, as well as of students who may desire that their efforts for self-culture shall be tested by the Society's Examiners. The Council have been authorized to notify the intention of H. R. H. the Prince Consort to offer annually a prize of twenty-five guineas to the candidate who, obtaining a certificate of the first class in the current year, shall have obtained in that year, and the three years immediately preceding it, the greatest number of such certificates. This prize cannot be taken more than once by the same can-

didate. It will be accompanied by a certificate from the Society setting forth the special character of the prize, and the various certificates for which it was granted. Several friends of the Society have authorized the Council to offer additional prizes for Practical Mechanics; Animal Physiology in relation to Health; Agriculture; Botany; Mining and Metallurgy; Political, Social and Domestic Economy; and English History and Literature. The Council gratefully appreciate the thoughtful interest which His Royal Highness our President has always manifested in the labours of the Society, and the liberal encouragement to the work of self-instruction which the valuable prize now offered will give to the intelligent and persevering student. To win that prize will be the highest distinction within the reach of the candidates for the Society's rewards.

Evening Schools and Classes.

The importance of evening schools and classes is now universally recognized; and though the provision for those objects is, as yet, in no adequate proportion to the want, it appears from the report of the Committee appointed to inquire into the state of popular education in England, made in the present year, that there now exist 2,036 evening schools, containing 80,996 scholars, in which the instruction is almost entirely elementary. The school life of those children whose parents are employed in manual labour must ever terminate at a very early age, and the tendency of late years has been rather to accelerate than retard the removal from school to work, and to shorten the duration of school life.

It appears from the report of the Commissioners that 65 per cent. of the children in elementary public schools are between the ages of 6 and 12; few go before 6, very few before 3; that attendance diminishes rapidly after 11, and ceases almost entirely at 13, only 5 per cent of the children at our day-schools being over that age.

Very much of the instruction acquired before 13 in the day-school will be lost before 18 in the workshop, if not preserved and extended in the night-school; and in proportion as the day-school is extended, will be the growth of a consciousness on the part of our young people that the night-school should complete what the day-school has begun. It has been found, as the result of careful inquiry by the Commissioners, that two millions and a half of children are now on the books of week-day schools, and that upwards of two millions of the children of working men are receiving education on week days. Year by year, hundreds of thousands of children exchange school for labour, and yet of this vast array our night-schools provide for less than a hundred thousand young persons. Can Christian philanthropy present higher aims than the intelligent and religious teaching and training of these adolescents during those years when the passions are strong, and the allurements to vicious gratifications well nigh overwhelming. And without neglecting its other objects, the Society has sought to encourage every suitable agency for the systematic instruction of the adult student, rewarding the meritorious by certificates of excellence, distinguishing the most successful by prizes of a substantial character, and affording to all the opportunity, by judiciously conducted examinations, of measuring their strength, discerning their short-comings, and obtaining at length the just rewards of persevering study.

Sanitary Improvements.

The improvement of the metropolis, by affording a complete system of sewerage, and an ample supply of pure water; by diminishing atmospheric impurities; by embanking the river; and by facilitating locomotion within and between the several quarters of the wide area of the London of our day, has frequently occupied the attention of our Society, and been forced upon the notice of the public by papers and discussions in this room. In a single decade, 400,000 persons have been added to the population of the metropolis. Its thoroughfares are thronged, not only by its own population thus increased, and by the numerous passengers who daily arrive at and leave the termini of its various railways, but by the countless productions which are either consumed within its borders, or constitute its exports and imports. The magnitude of its commerce is attested by its railways, its docks, and its shipping; and it may suffice to state here that in the year 1860, nearly 20,000 vessels, of an average tonnage exceeding five millions of tons, entered inwards or cleared outwards to or from our colonies and foreign countries, and upwards of 27,000 vessels of an aggregate tonnage exceeding four millions of tons, entered or left with cargoes from or for places within the United Kingdom.

Locomotion.

Notwithstanding the great rapidity with which long journeys by sea or land may now be performed, so that a traveller may reach Dublin from London in 12 hours, London from Geneva in 26 hours, and Liverpool from New York in eight or nine days, it requires now as much time to cross the metropolis, whether from north to south, or east to west, as when the journey from Dublin to London occupied three days, from Geneva to London six days, and from Liverpool to New York six weeks or two months.

The thoroughfares and means of locomotion which sufficed for 1851, are wholly unequal to the wants of 1861; and to provide adequate accommodation for the transit of the metropolitan traffic, involves questions which have hitherto received no satisfactory solution In a few years districts have been added to the metropolis which would of themselves constitute large cities, and this extension proceeds in an accelerated ratio.

Meanwhile, considerable progress has been made in the construction of subways, which were regarded as visionary in 1851, when a discussion took place in this room on a proposal for combining with the embankment of the Thames a terraced highway with a railway arcade and tunnels for water, sewage and gas. What practical difficulties might prevent the completion of such an undertaking, I know not; but whether regarded for its combinations, its grandeur, or its usefulness, such a work would rank with those structures which, more than aught besides, even in their ruins, testify to the greatness and power of the Roman Empire.

Cotton.

There are few subjects to which the Council has more perseveringly directed the attention of our

manufacturers, than the importance of lessening the dependence of this country on the American States for a supply of raw cotton. Two papers of much interest were, at the request of the Council, read by Dr. Forbes Watson ; one in the session of 1858-9, on the "Growth of Cotton in India," and one in the session of 1859-60," on the "Chief Fibre-yielding Plants of India." The last paper is especially valuable for its large amount of information and its numerous illustrations, furnished at the expense of the Indian Government; but at present my chief attention will be given to the first, which describes the capabilities of our Indian Empire for the growth of cotton.

At the recent meeting of the British Association, it was said by a Manchester capitalist that a capital of two hundred millions is embarked in our cotton manufactories, and that four millions of people are in some way or other dependent on the trade in cotton ; that the value of our cotton goods yearly manufactured is eighty millions, of which the portion exported is equal to fifty-five millions ; that the cost of the raw material we consume is forty millious ; and that of every 100 pounds of raw cotton consumed, we have been supplied by the United States with 85 pounds.

The actual weight of cotton imported into this country from all parts of the world was, in 1859, 1,225 millions of pounds, and the quantity annually grown in India is estimated by Dr. Forbes Watson at upwards of 2,400 millions of pounds, or double the average consumption of this country. He stated that in one province alone, Berar (where the quality of the cotton grown is second to none in India), a supply could be furnished to this country equal to one-third of our entire consumption ; and that Indian cotton can be grown at a rate varying from 1¼d. to 1½d. a pound, and delivered in England at 4d. per pound, notwithstanding the present imperfect means for the transit of cotton from the interior to Bombay. In the address which I delivered from this chair in the year 1859, I ventured to anticipate a time when, by means of increased intelligence and capital, directed to the cultivation of the cotton plant in India, and improved communication with the interior of that country, we should receive from our own dependency, in large measure, a raw product of vast importance to our manufacturing community and the well-being of our population ; thus cheapening a material supplied to Europe to a great extent by the United States, and in that country the product of slave labour. In a subsequent address I intimated that it was impossible to exaggerate the importance of the subject, inasmuch as millions of hands are engaged in or dependent on our cotton manufactures, and to them a stoppage in the supply of raw cotton would be equivalent to a food famine.

British Colonies and Dependencies.

The aggregate population of our colonies and dependencies is there stated at 195,000,000 ; their import and export trade at £176,000,000 ; their revenue at £44,000,000; and the amount of their imports from the mother country at £46,000,000, being nearly one-third of our total exports to all countries.

The most remarkable characteristic of our recent colonial history, is the rapid growth of those valuable possessions from infancy to manhood ; from settlements, ruled by an administrative department in the mother country, to commonwealths, possessing native legislatures, and entrusted with the organization of their executive governments.

Their growth in population, trade and material wealth, has but few parallels. Thus, in South Africa the export of wool has increased from six millions of pounds in 1851, to 24 millions in 1859 ; and of wine, from 250,000 gallons in 1852, to nearly 800,009 in 1859.

In North America our colonial population has increased from 2½ millions in 1851, to 4 millions in 1859, and the imports from a sum less than 5 millions in 1850, to more than 9 millions in 1859.

On the western shores of North America, a province known as British Columbia has recently started into existence, and bids fair at no distant day to rival Australia. The gold fields of British Columbia will assuredly attract an active, energetic population, whilst its position on the shores of the Pacific must confer on the colony great importance as a naval station.

The noble Earl who presided with so much ability at the last aniversary dinner of the Society, mentioned, on that occasion, as a fact within his own knowledge, that between the year 1847, when he went to Canada as Governor-General of the North American Provinces, and 1855, when he left the country, the revenue and trade of those provinces had quadrupled.

In Australia the population has more than doubled in ten years, whilst the aggregate revenue has risen from a million and a quarter to six millions a year, and the imports and exports have increased from eight millions in 1850, to 47 millions in 1858 ; and it is computed that the gold obtained from Australia in ten years, has exceeded in value one hundred millions sterling.

Our colonies and dependencies, including India, will be well represented at the forthcoming Exhibition, as all, with the exception of the Cape, have entered with ardour into the industrial and artistic rivalry which the undertaking has enlisted.

ANALYSIS OF STAINS, SUPPOSED TO BE CAUSED BY BLOOD.*

It is a matter of the highest importance to know if stains, supposed to be caused by blood, can be correctly analysed ; and also if it can be determined what animal the blood came from, but more especially if it is human blood. These questions generally bear reference to judicial cases, and often involve a matter of life or death.

It is the more necessary to examine these questions, as certain authorities have asserted that not only can blood stains be analysed correctly, but that even the animal from which the blood came can be firmly established.

I will examine, one by one, the tests given us by these authorities.

If the spots are upon some fabric, they must be cut out, but if not, they must be carefully scraped off. In either case, they must be placed in some clear water, keeping the spots in the water, but near the surface. If these spots are blood spots, a heavy stream will fall to the bottom of the water.

* By Thomas D. Tease, Esq., F.C.S., F.S.A., Jamaica.

This is the method given by my late much lamented master, M. Orfila, the celebrated toxicologist. I mention this, as Dr. Taylor, in his late work on Medical Jurisprudence, would seem to take the credit to himself of originating this simple mode.

Supposing that the heavy stream falls, there is certainly an indication of blood ; but if there is no stream, an indication of the presence of blood is wanting, chemically speaking.

If the heavy fluid is formed, then take the pieces out of the water carefully : draw off the supernatant water with a pipette, so as to leave only what may be presumed to be blood : with care this can be easily managed (Orfila). Put this fluid into six test-tubes, and a portion on a glass slip to be examined later under the microscope ; these portions to be tested in the following manner :—

The quantities, of course are so small that it would be useless to examine the spots for fibrine, important though such an examination would be, if possible. On an average, in a healthy body, blood is said to contain only two parts in a thousand of fibrine. Seeing the smallness of the quantities, the attention of the analyst must be directed to the albumen and the iron. It will be useless to seek for the characteristic colouring matter of the blood (hematosine) after the lapse of some days, these spots being, in all probability, several days old before they pass into the hands of the analyst.

Before examining the tests, I must draw special notice to this fact, in the two tests I shall first mention, the spots must be fresh, as these two tests do not shew themselves on blood that has been kept for some time. Indeed, in one case mentioned by Mr. Taylor, some true spots of blood which had been operated upon, refused to answer to these two tests after twenty-four hours in warm weather. I shall, however, mention them :

1st.—If the stains are recent, take a little of the red fluid that has been collected, and mix it with some water ; if this fluid dissolves readily in the water, and imparts to it a rich red hue, the colouring matter of blood (hematosine) is indicated. I cannot but consider this test as valueless, not only because freshness is a necessity, but because other colouring matter may produce the same tint when dissolved in water, and the supposed blood-stains may be only stains produced by other colouring matter, not hematosine.

2nd.—To this solution add a few drops of weak ammonia, taking special care to add very little ammonia (a glass rod dipped in a weak solution of ammonia, shaken and dipped in the red solution, will be the safest). If the red solution becomes crimson or green, it is not blood ; but if the solution remains unchanged, then the evidence is still stronger that this colouring matter is the hematosine of blood. This is certainly a most valuable test, *if* there are no red colouring matters, other than hematosine, which are unaffected by ammonia.

But I cannot dwell too strongly on the fact, that these two tests, indicating the presence of the colouring matter of blood, require that the stains be fresh.

In the following tests freshness is not necessary.

3rd.—Take some of the thick liquid, collected from the stains ; add a quantity of concentrated ammonia, and see if the colour now changes to a brown tint ; if so, I think we have reason to suspect iron, but we are far from having established its presence, to prove which we must apply all the known tests for iron, which our small quantities to be tested will not allow. We must, therefore rest contented with a mere indication. And even should we determine the presence of iron in the stains, that would not prove, of itself, that the stains were blood-stains. It is evident that this test possesses but little value, seeing that we can produce the same reaction from other stains besides blood-stains.

4th.—Boil a little of the red fluid, and see if it coagulates, if the colour is destroyed, and if a flocculent brown precipitate is formed. The coagulation will indicate albumen, but that is all.

5th—Take the flocculent brown precipitate, filter and dry it, and see if it becomes a black resinous substance, insoluble in water; if so, then add some caustic potash, boil again, and see if a green coloured solution is formed. This would lead us again to suspect iron.

6th.—Now take some of the suspected fluid, add to it some strong nitric acid, and if the fluid coagulates albumen is again indicated.

But I must protest against these tests ; they are unchemical and unsatisfactory; we can obtain from them, at most, but indications of iron, albumen, and, if the spots are, fresh hematosine. I have purposely employed the term "indications," for I most emphatically assert, that no chemist has a right to say "such and such is the composition of such a body," if each material composing that body has been determined on the faith of one or two tests, and these tests the very reverse of conclusive ; such reasoning could not be admitted in a chemical laboratory. As an analytical chemist, I would not do so in any commercial analysis, fearing a mistake on my part, leading to future exposure by some brother chemist, as in a case I well remember : a chemist had relied on two tests, and on them determined that a certain substance contained lead ; another chemist examined the same substance more carefully, and found that it contained bismuth, and not lead. If a chemist dreads the exposure of a mistake, caused by an incomplete analysis of a mere commercial substance, how much more would he fear swearing a fellow creature's life away on mere indications.

For I assert, that to make a complete analysis of a fluid, suspected to be blood, that the iron, the albumen, the hematosine, and the fibrine should each be separated and each examined by all the known tests for each ; and if one test fails, I maintain that the analysis is incomplete, according to laboratory practice.

But there is another important aid, the microscope, which determines the presence and the form of the corpuscles, if present, this is a most valuable test ; but it is simply a microscopical test, unsupported by a satisfactory chemical analysis.

I, therefore, come to the conclusion that, considering the small quantity of matter to be acted on, we can only obtain presumptive evidence that blood is the cause of these stains. I must again remind the reader that the determination of these questions may involve a matter of life or death, and that the accused has a right to the benefit of a doubt, the more especially as such an examination as I have just described, made in a chemical

laboratory, where only commercial interests are concerned, would not be received.

I am loath to leave this subject without giving a striking proof of how elementary our knowledge of blood is. Fowne's work on Chemistry, a text book in very general use, contains this assertion:—"The colouring matter of blood contains albumen, and coagulates by heat, and by the addition of alcohol; this albumen cannot be separated, and all attempts to isolate the hematine, or red pigment, have consequently failed. From its extreme susceptibility of change nothing is known of it in a state of purity." Now, Muller, in his "Manual of Physiology," says quite the reverse:—"When blood, coagulated by alcohol, is boiled in this re-agent, the hematine is dissolved, and we thus succeed in freeing it from the whole of the adherent albumen."

We have now to determine if human blood, submitted to a microscopic examination, can be distinguished from the blood of any other animal. The circular form of the globules confines our attention to mammiferous animals, to the exclusion of the dromedary and the lama. This subject has already been so satisfactorily discussed by Taylor, that I cannot do better than subjoin the following quotation:—"The only microscopic distinction between the blood of man and domestic animals, consists in a difference in the size of the blood globules. This, however, is only an average difference, for the globules are found of very different sizes in the blood of the same animal. In making use of this criterion, it would be necessary to rely on the majority of the corpuscles seen in a given area, and under the same power of the microscope. The corpuscles in man, the dog, the rabbit, and the hare, are nearly of the same size. In the blood of the sheep and goat, they are smaller than in that of any other animal. According to Gulliver, the measured diameter of the globules in human blood varies from 1-2000th to 1-4000th of an inch. From the examination of various specimens of human blood, I (Taylor) have found the average diameter of the globules to be the 1-3500th of an inch, the maximum size being 1-3000th and the mimimum 1-5000th. According to Guliver, 1-4267th in the ox, in the cow, according to my measurement, 1-4000th to 1-2000th. In the sheep, according to Gulliver, 1-5300th; according to my measurement, 1-5330th to 1-6000th. In the goat, according to Gulliver, 1-1366th.

"These measurements apply to recent blood, which has not been allowed to dry in animal and vegetable stuffs. In this case a distinction might be made between the blood of a human being and the sheep. When blood is dried on clothing, and it is necessary to extract the corpuscles by means of a liquid of a different nature from the serum, we cannot rely on slight fractional differences, since we cannot be sure that the globules, after having been dried, will ever re-acquire, in a foreign liquid, the exact size which they had in serum. Medical evidence must, therefore, be based, in such cases, on a mere speculation."

Many other considerations might be added, but they appear superfluous after the very conclusive summary I have just quoted.

HISTORICAL AND SCIENTIFIC FACTS ABOUT PETROLEUM.

Within the last three years there has sprung up in this country an important and extensive branch of industry—the refining of petroleum, or, as it is sometimes called, a mineral oil. This is already a staple article, and its use as an illuminator, is becoming every day more extended. When properly manufactured it is not explosive, it affords a brilliant flame, it can be furnished at a moderate price, and, moreover, its sources of supply in this country are abundant. The subject is one of so much general interest that we are induced to publish the following interesting article concerning this substance, which was sent to us by a member of the Chemical Society of Schenectady, N. Y.:—

Petroleum is not of constant composition, but is a variable mixture of numerous liquid hydro-carbons, as benzole, naphtha, kerosolene, &c., with paraffine, naphthaline and asphaltum, solid hydrocarbons. It is of a very dark green colour, and in density varies from a thin fluid, lighter than water, to a thick viscous liquid, heavier than water. The lighter qualities yield the larger proportion of burning oil.

The evidence of the most ancient occurrence of petroleum is among the ruins of Ninevah, whose existence dates back more than two thousand years before the Christian era. In the construction of this city, an asphaltic mortar was extensively employed, the asphaltum being obtained by the evaporation of petroleum.

A later mention is found in the accounts of Babylon, whose walls were cemented with asphaltum, which was poured, in a melted state, between the blocks of stone, and an indestructible mortar thus secured. This asphaltum was procured from the fountains of Is, which were about one hundred and twenty miles above Babylon, on the Euphrates. Together with saline and sulphurous water, it issued from a rock and was conducted into large pits. The oily matter was then skimmed off and solidified by atmospheric evaporation. These springs, from the abundance of their products, attracted the attention of Alexander, Trajan and Julian, and even at the present time, asphaltum procured from them is sold in the neigbouring village of Hits.

From time immemorial asphaltum has been found on the shores of the Dead Sea, and this is one of the most remarkable localities for it. This sea, as is well known, is of supposed volcanic origin; and is the probable site of the ancient cities of Sodom and Gomorrah. Its surface is thirteen hundred feet below the surface of the ocean, and it has been fathomed to the depth of two thousand feet. In several places no bottom has been reached, and, owing to internal convulsions, the depth changes from time to time. The water is very dense, holding in solution twenty-five per cent. of solid matter, of which seven per cent. is salt. The bituminous substance is up-thrown from below and towards the centre of the sea it is found in a liquid state, like petroleum; but it is probably solidified by evaporation, as it appears upon the shores in hard compact masses. The explanation of this phenomenon is that a connection between the sea and some internal volcano exists, whence this substance is ejected.

In the vicinity of the Caspian, the Bakoo springs have yielded large quantities of oil, and are widely celebrated. Some of the Persian wells have furnished fifteen hundred barrels a day, and throughout this region this material, under the name of Naphtha, is very generally burnt for its light.

At Rangoon, in Burmah, petroleum has been obtained for many years, and at this time there are over five hundred wells, which annually afford four hundred thousand hogsheads. The oil occurs in a strata of blue clay; wells about sixty feet deep are dug, into which the petroleum oozes. This is sometimes used in it natural state, but more frequently it is first purified by distillation with steam. The raw material is also mixed with earth and used as fuel.

In Europe there are few abundant springs. On one of the Ionian Islands there is an oil fountain which has flowed for over two thousand years: and the oracular fires of ancient Greece have been attributed to similar sources. Oil springs also occur in Bavaria, in the Grand Duchy of Modena, at Neufchatel, at Clermont and Gabian in France, and near Amiano in Italy. Petroleum procured from the last-named locality is used for lighting the city of Genoa, but elsewhere in Europe it is not employed, to any extent, as an illuminator.

On this side of the ocean there is an enormous quantity of this substance. Upon the island of Trinidad, one of the West Indies, at a distance of three-fourths of a mile from the sea, is a lake of asphaltum three miles in circumference. Near the banks the asphaltum is hard and cold, but as you approach the centre the softness and the temperature increases, until finally it is liquid and boiling. From the bubbling mass proceeds a strong, sulphurous odour, which is perceptible at a distance of ten miles. Between the banks of the lake and the shore of the island is an elevated tract of land, covered with hardened asphaltum, upon which vegetation flourishes. The explanation put forward in connection with the Dead Sea, is equally applicable in this case.

Upon others of the West Indies petroleum has been obtained, as well as at several places in Central and South America; but it is in the northern portion of this continent that the abundant reservoirs of this substance are located; and it seems truly wonderful that their extent and richness should not have been discovered at an earlier period. For many years the Seneca Indians collected petroleum, and, under the name of Seneca oil, sold it as a remedy for rheumatic complaints. At numerous places in the Middle States it was found in salt borings, and was collected and burnt by the farmers, but it was not till August, 1859, that it was obtained in noticeable quantities. At this time oil was "struck" upon Oil Creek, Venango County, Pennsylvania, by sinking an Artesian well to the depth of seventy feet, and for many weeks a thousand gallons a day were pumped from it. The news of this discovery spread far and wide, and gave rise to an "oil fever." Thousands flocked to this vicinity in the hope of making their fortune. Before the close of 1860 there had been over a thousand wells bored, many of which were productive, but a large proportion returned nothing. Some of the adventurers have been very successful, and have made large amounts of money; but, as in all commercial "fevers," a large number of persons have been utterly impoverished by their speculations. The mere sinking a well by no means insures a bountiful flow of oil. The petroleum is stored in fissures formed by the upheaving of the earth's crust by volcanic action; and these fissures are perpendicular rather than horizontal in tendency, as is proved by the fact that at wells, but a few rods apart, the oil is "struck" at very different depths. The lowest parts of the fissures contain water, above which is the oil, while in the highest portion there is a quantity of gas. If, therefore, the well strikes the fissure at the lowest part, the water will be forced up by the pressure of the supernatant oil and gas. Persons ignorant of the formation sink a well at random, and perhaps strike a fissure; but obtaining nothing but water, they abandon the spot as worthless, whereas after removing the water by pumping, a large quantity of oil might be obtained.

In some localities in Ohio, as in the case in Burmah, the ground is saturated with the oil, and wells several feet in diameter are dug, into which the oil oozes. Porous limestone, containing petroleum, is found in some sections of the West, and has been subjected to distillation with profitable results.

In regard to the origin of petroleum, scientific authorities differ; but the theory most generally favoured is, that it is the product of the slow distillation, at low temperatures, of organic matter in the interior of the earth; the vapours being condensed in the previously-mentioned fissures and the surrounding soil. The lake of Trinidad and the bituminous matter of the Dead Sea may also be referred to a similar source. But for how many centuries must this operation have been going on to have effected such enormous results?

Of the many uses to which petroleum and its derivatives are applied, that of illumination is the most important; and the process of refining is exceedingly simple. The crude material is put into a large iron retort, connected with a coil of iron pipes, surrounded by cold water, called the condenser. Heat is applied to the retort, and from the open extremity of the condenser, a light coloured liquid of a strong odour soon flows. This is naphtha, and is very volatile and very explosive. Some refiners mix it with the burning oil, and numerous accidents have resulted from such mercenary indiscretion. It is usually run into a separate tank. After the naphtha has passed over, the oil used for illumination distills off. Steam is now forced into the retort and the heavy lubricating oil driven over. There now remains a black, oily, tarry matter, sometimes used to grease heavy machinery, and a black coke, employed as fuel. There are, therefore, five substances separated in this operation, but only the first three are of any economic importance..

The naphtha is used as a substitute for turpentine in paints, or by repeated distillations the benzole is separated from it and employed to remove spots from fabrics. This, however, is rather a drug in the hands of the refiner.

The burning oil, as it comes from the retort, is of a yellow colour, and in order to remove this, it is placed in a large lead-lined cistern, and agitated with about ten per cent. of sulphuric acid. After

the acid and impurities have subsided, the oil is drawn off into another tank and agitated with four per cent. of soda lye. This last operation is to remove any acid remaining with the oil, and also to extract the residue of the colouring matter. In fact it is sometimes employed alone and a very good oil obtained. The oil is now agitated with water to remove the soda lye, and is then ready for consumption. The colourless oil is by no means the most economical, but on the contrary more light is obtained from the yellow article.

The heavy oil is cooled down to 30° Fah. when the paraffine crystallizes out, and is separated from the oil by pressing. It is further purified by another pressing and by alternate agitation, in a melted state, with sulphuric acid and soda lye. It is then moulded into candles. It is a curious fact that the composition of paraffine and good coal gas is exactly the same.

In Egypt a substance derived from petroleum was used in embalming bodies; and in Persia and the neighbouring countries asphaltum is used to cover the roofs of the houses and to coat the boats. In France asphaltic pavements have been successful in several cities, and for the protection of stone no material is better adapted. Mixed with grease the Trinidad asphaltum is applied to the sides of vessels, to prevent the borings of the teredo, and with quicklime it affords an excellent disinfectant. Among the products of the distillation of petroleum are naphthaline and keresolene. The former is the substance from which is obtained aniline, the base of the beautiful colours mauve, magenta, and solferino. The latter has been proposed as a substitute for chloroform and ether. Many other substances have been separated, but as yet none of them have been applied. As this is comparatively a new field many discoveries may be confidently expected in the course of a few years.—*Scientific American.*

THE OIL WELLS IN ENNISKILLEN.

A correspondent of the Toronto *Globe*, under the signature "Sigma," describes the flowing spring of Petroleum in the township of Enniskillen, which has been reached by boring to the depth of 208 feet. He says:—

"On the 16th of this month, a Mr. Shaw, lately of Port Huron, Michigan, a dauguerrean artist, and formerly of Kingston, Canada West, struck oil, as it is termed, near the road running between the second and third concessions of this township, on the north part of the east half of lot 18, in the second concession. The well is sunk about 208 feet below the surface of the earth, and measures four feet by five at the top, but gradually narrows, I presume, towards the bottom. The first fifty feet was a clay soil, and the remaining 158 feet was drilled into the rock. You can form some idea of the enormous pressure with which this liquid was forced up from the bowels of the earth when I tell you, that within fifteen minutes of the last drill of the chisel, the oil was overflowing the surface of the earth, the well being entirely filled. The great mystery then was, how they should controul this spontaneous flow, and it is remarkable bow easly it was accomplished. An iron two and a half inch pipe was provided, and on the end which was to enter the cavity drilled into the rock, there was a leather bag twelve feet long, filled with flax seed wrapped around the pipe, and this was lowered to the bottom of the well, and by means of the seed swelling the cavity was tightly closed and oil was prevented from escape, except through the pipe. It rushed up this pipe after this had been accomplished, and spouted into the air twenty feet above the surface of the earth. Another pipe was provided only three quarters of an inch in diameter, and around one end was wrapped another seed bag, and this was inserted within the two and a half inch pipe, which reduced the flow by this means to the quantity that could pass through this three-quarter inch pipe. There are four large receiving tanks, capable of holding each 120 barrels or about 5,000 gallons each, placed at a distance of 30 feet from the well, and connected from the main upright pipe through which the oil flows, are four hose, one of which feeds each of the tanks, and from the tanks the oil is drawn off into barrels, containing 40 gallons each. I timed the filling of these barrels and found that in one minute and forty-five seconds each barrel was filled. From the time that the flow of oil was brought into partial subjection (which was on Friday evening) up to this time, upwards of 2,000 barrels have been taken away, and more than this quantity has been lost. The tanks are always overflowing, although they are constantly drawing it off into barrels, which proves that even although the yield is subdued to about one-fourth of its natural proportions by means of the three-fourth inch tube, that if additional tanks were provided the main pipe would feed them. You can easily estimate the quantity of oil that could be obtained from this well if the main feeder were three inches in the bore instead of being less than three quarters of an inch. The quantity is prodigious.

"The oil is sold here at two and a half cents a gallon, but in reality it is worth nearly ten cents in the crude state. Its colour is a beautiful dark bottle green. Its specific gravity is 42, and experienced men pronounced it a superior quality to the oil taken from the surrounding wells. Owing to the want of barrels and other conveniences respecting its removal, only some 670 barrels are taken from the well each day. They are preparing additional reservoirs for receiving it, and in a few days, it is to be hoped, this loss will be obviated.

"How long this spontaneous flow of oil will continue it is impossible to tell, but it shows no sign of diminution at present. There was no surface oil at any time in this well. That is to say, no indication of oil was manifest until the rock was drilled upwards of 100 feet.

"The next best well in this region is situated on lot 19 in the second concession, on the north end of the lot. It yields less than 30 barrels per day. There have been few, comparatively, who have drilled into the rock, and it is my opinion from the information I have received here, that all along this line rock oil will be found.

"Oil Springs is quite a village. There have been upwards of 100 houses erected here since last spring. Owing to the Southern rebellion, much less has been done here this last six months than would have been done had it not occurred. We

are mainly dependent upon the capital and enterprise of the Americans to develope the rich resources of this trade. They have a settled population in the village of about 700 souls, I am told. A newspaper is to be printed here, the first number of which will issue shortly. Eighteen months ago this was a wilderness! A Buffalo company has purchased lot 23 in the third concession, and have made a partial commencement to sink a well. There are one hundred teams engaged in the oil business. The plank road from Wyoming to Oil Springs will be completed immediately. There is not more than one quarter of the wells in active operation, owing to the lack of demand.

"Upwards of 2,000 persons have already been to see for themselves the wonderful oil well in Enniskillen."

THE BUILDING FOR THE INTERNATIONAL EXHIBITION OF 1862.

General Description.

In the general design of the building, its suitability for future International Exhibitions has been kept steadily in view, and it has a much more permanent character than the famous Crystal Palace erected for the 1851 Exhibition.

It differs therefore from its predecessor in many essential particulars. It is more commodious, more imposing in its interior, more varied, more suitable for Exhibition purposes, while from without its aspect is of impressive magnitude and grandeur.

Here glass and iron are no longer the main features of the design, but are succeeded by lofty walls of brickwork, which surround the walls on all sides, and form the walls of the fine art galleries. The east end and west sides, by being continued past the southern arcade of the gardens, have a frontage of 750 feet, and that on the south is 1,150 feet. The north front is the lower arcade of the gardens, which is having a permanent upper story added to it. The interior space thus enclosed is entirely covered in by roofs of various heights, and is divided into nave, transepts, aisles, and open courts; the latter, occupying comparatively a very small portion, are roofed with glass as in 1851, but the other parts have opaque roofs, and are lighted by clerestory windows.

The interior supports are hollow cast-iron columns, as in 1851, of somewhat larger dimensions, being a foot wide, with half an inch of metal in them. They are so arranged as to come at intervals of 25 or 50 feet from centre to centre; in fact, 25 is the the unit here as 24 was in 1851, and you will find nearly all the leading dimensions, both vertical and horizontal, to be multiples of that number. The exceptions to this rule are the nave and transepts, which are 85 feet wide; the former runs east and west, and terminates in the centre of those fronts, having its central line 81 feet north of the centre line of the building; the latter extend north and south from the ends of the nave throughout the whole width. At the intersection of the nave and transepts are the great domes. The aisles are continued all round the nave and transepts, and the space enclosed by them forms the open or glass courts.

The columns are supported differently from what they were in 1851. On that occasion they were attached to connecting pieces, which, terminating in a large flat base plate, rested on concrete laid flush with the ground; these connecting pieces of course varied in height to suit the slope of the ground. This has been avoided in the present building by bedding the colums themselves on York slabs laid on brick piers, which are founded on concrete; the slabs being all adjusted to the same level throughout by varying the height of the brickwork, only one length of column is used, and the facility of setting them up is thus greatly increased.

At the north ends of the east and west fronts are the two annexes, temporary, supplementary structures, designed for the exhibition of machinery and other ponderous objects, which could not be conveniently placed in the main building.

The total area roofed in is 988,000 square feet; it is therefore, considerably larger than the 1851 Exhibition, which only occupied 799,000 square feet. It has also, when actual covered space is alone considered, slightly the advantage of the Paris Exhibition, which had a covered area of 953,000 square feet. But if we compare the total space covered and uncovered, occupied by each, Paris is considerably larger, for the better suitability of its climate for out of door display enabled the authorities of that Exhibition to increase the area of ground given up to exhibiting space by 547,000 square feet, while, with our variable climate, it has not been thought advisable to have more than 35,000 feet of ground unroofed; so that the total areas, covered and uncovered, occupied by the two exhibitions, are 1,500,0000 square feet for Paris, and 1,023,000 square feet for 1862.

The French Exhibition, therefore, considerably exceeded ours in size, but it was not nearly so compact in form, and its temporary annexes made up a very large portion of it, occupying 600,000 of the 953,000 square feet, while our two annexes do not amount to more than one-third of the total area.

In the construction af this magnificent building, there are 7,000,0000 bricks used; these have all been supplied by Messrs. Smeed, of Sittingbourne. Nearly all the cast-iron work has been supplied from the Stavely iron-works, in Derbyshire; there are upwards of 4,000 tons of this metal in the building; and to show what care has been taken with the castings, only four girders have proved defective, by breaking in the hydraulic press.

There are upwards of 820 25 feet columns, equal in length to 4 miles, and if the 1,266 girders used were placed end to end they would reach a distance of 6 miles. The wrought iron is chiefly supplied by the Thames Iron Company, the builders of the "Warrior." This firm has undertaken the supply of all the iron for the domes, the groined ribs, the 50 feet roofs, and the iron trellis girders which support them; the total quantity of wrought iron in connection with these parts amounts to 1,200 tons.

The timber work is executed partly at the works of Messrs. Lucas, at Lowestoft, and partly at Mr. Kelk's works at Pimlico; the former prepare all the window sashes, &c., &c., by machinery; and the latter constructs the heavy ribs of the nave and transepts. Upwards of 1,300,000 super feet of floor will have to be laid.

To cover the roofs 486,385 square feet of felt are used, equal to 11 acres; and to complete the whole of the glazing requires 553,000 super feet of glass, which weighs 247 tons, and would cover 12¾ acres.

THE MACHINERY DEPARTMENT OF THE EXHIBITION OF 1862.

Classes 5, 7, 8, and 10.

No. I.

The business of the machinery department, in classes 5, 7, 8, and 10, is, perhaps, the most onerous of all the business of the classes into which the industrial products are to be distributed for Exhibition.

The supply of steam to work the numerous machines which are to be in motion, is to be furnished from a number of large double-flue boilers, 30 feet in length, of 50 nominal horse power each, to be supplied by Messrs. Hick & Sons, of Bolton, sufficiently powerful to work the whole of the machinery in motion at once, without any necessity for stopping any portion of it, or of working parts of the machinery alternately. The disadvantage of an under-supply of steam in former exhibitions was strongly felt, and it has been the aim of Her Majesty's Commissioners, in this particular, to have an ample supply of steam for every demand, without restriction. The steam from the boilers, which is to be of 70 lbs. pressure per square inch, will be conveyed through large pipes down the passage of the western annex, which is to contain all the machinery in motion; the extent of steam pipe will be unprecedented in engineering practice. The annex is nearly 1,000 feet in length from north to south, and the boiler-house will be built at a distance of at least 100 feet from the north end, near the Kensington road. There will be two lengths of pipe about 900 feet each, and a third and shorter length, which, with the junctions required, will amount to a total length of upwards of 2,500 feet, for the ramification of steam pressure throughout the annex. It is not intended by Her Majesty's Commissioners to erect steam engines specially for the services, but to make free use of the numerous and various steam engines which will be exhibited, the intending exhibitors of which generally are desirous to have them put in motion. The steam pipe will be provided with expansion-boxes at frequent intervals, to take up the unavoidable expansion and contraction of metal pipes subjected to heat and cold alternately, and they will be thickly clothed in felt, and bedded in ashes, sand, or other non-conducting substance, so as to prevent loss of heat by radiation and condensation of steam within the pipe. Such a provision, though essential and highly important, is by no means so difficult to mature as appears to have been assumed by certain writers for the press; indeed, the proportion of steam lost by condensation may be reduced to a very small fraction, by the expedient of superheating it before it leaves the boiler-house, and drain-cisterns will be provided at suitable spots for the reception and collection of the water precipitating within the pipes.

The exhaust steam, discharged from the numerous steam engines at work in the annex, will be intercepted by large return exhaust pipes, laid parallel to the steam pipes, and conducted back to the shaft or chimney attached to the boiler-house, into which it will be discharged. Thus, the whole operation of the steam, conducted to the steam engines and back again, will be conducted without noise or nuisance; and the spectacle which would otherwise be presented of numberless clouds of spent steam escaping from the various engines through the roof of the annex, according to the usual routine of worshops, will be wholly prevented. The exhaust pipe, like the steam pipe, will be fitted with expansion-joints and drain-cisterns.

The gross area of the western annex is little more than four acres, or about 180,000 square feet; of this area 16,000 square feet are to be set apart for branch refreshment rooms, about 70,000 square feet for the exhibition of foreign machinery, and about 90,000 square feet for the machinery of the United Kingdom. An additional area of 20,000 square feet will probably be reserved in the eastern annex for the exhibition of machinery.

Miscellaneous.

Railways of the World.

There are 31,800 miles of railroads in the United States, of which there are 20,688.51 in the free and but 11,111,43 in the slave States. The total cost of the entire lines has been $1,192,302,015. Last year there were only 631 miles built, against a previous annual average of 2,000 miles. But although the construction of roads decreased, the traffic on all the northern roads was greater than on any previous year. The condition of our railroads is favorable at present.

The length of railways in operation in Great Britain and Ireland is 10,750 miles 300 miles of which were built last year. Their entire cost of construction amounts to £355,000,000 (about $1,775,000,000). There are 5,801 locomotives, 15,076 passenger carriages and 180,574 freight cars used on these railways. Last year they carried 163,435,678 passengers, 60,000,000 tuns of minerals and 20,500,000 of general merchandise.

France has 6,147 miles of railway, worked by 3,000 locomotives; 3,500 miles of new lines are being constructed. Total cost of completed lines $922,200,000.

Prussia has 3,162 miles in operation; Austria 3,165 miles; the other German States have 3,239 miles; Spain has 1,450 miles; Italy, 1,350; Rome, 50; Russia, 1,289; Denmark, 262; Norway, 63; Sweden, 288; Belgium, 965; Holland, 308; Switzerland, 600; Portugal, 80; Turkey, 80; Egypt, 204.

In the British colonies, there are 1,408 in the East Indies; Canada, 1,826; New Brunswick, 175; Nova Scotia, 99; Victoria, 183; New South Wales, 125; Cape of Good Hope, 28. Making a total of 14,277 miles in operation in the British Empire; the entire cost of which has been $2,086,765,000.

In Mexico there are 29 miles of railway; Cuba, 500; New Grenada, 49½, (Panama Railway); Brazil, 111; Chili, 195; Peru, 50; Paraguay, 8.

The total length of railways in the world is 69,733 miles. Their estimate cost is about $5,877,-200,000. Nearly one half the length of lines belong

to the United States; and one fourth to Great Britain and Colonies.—*London Engineer.*

Auriferous Rocks of Victoria.

The area of the quartz-bearing rocks at Victoria, in Australia, is estimated at 25,000 square miles. The total area of the extent of land at present mined upon in that colony is 561 square miles. Thus 89,920 square acres, have produced gold to the amount of £92,787,236, on an average of about £1,032 per acre, and there yet remains upwards of 15,000,000 acres almost everywhere intersected by quartz veins of greater or less thickness, which are as yet intact by the pick of the miner.

The Exhibition of 1862 and the Working Classes.

A club has been formed at Sudbury, to enable the working population of that town to visit the Great International Exhibition of 1862. The club will receive deposits at the rate of not less than 3d. per week for a single ticket, and children under 12 years of age 2d. per week; and it is expected that not only will considerable resources be thus collected, but that great advantages will also be derived in regard to railway fares and accommodation in town from the principle of organisation. The mayor (Mr. S. Higgs) has offered 1s. each to the first 200 *bona fide* working men who subscribe. A similar club has been formed at Stowmarket and one or two other points in the eastern counties.

Charcoal in Medicine and as a Disinfectant.

Charcoal powder has been for a long period a favorite remedy in America, the Indies, and in many parts of Europe, for dysentery, and it it extensively used, with success, as a remedy for nervous dyspepsia and other painful disorders of the stomach and bowels.

Dr. Beloc, Surgeon-Major in the French Army, says, in nervous affections of the stomach and bowels; in those complaints which are so prevalent, and attended with so much pain and inconvenience, but which do not confine the sufferers to their bed, such as weight and uneasiness after eating, nervousness from laborious digestion, dyspepsia, pain in the chest, waterbrash, &c.; for each of these disorders, the powder of charcoal is the most effectual in relieving pain, restoring the digestive powers, improving the appetite, and enabling the stomach to bear food. Some vegetable substances contain less than 75 per cent of carbon, the remaining 25 per cent consisting of earthy mineral and deleterious matter. Charcoal possesses the property of absorbing noxious gases. M. Lowitz, a German chemist, about the year 1789, first applied this substance for deodorization and purification. M. Theodore de Saussure, by a series of experiments, proved its power of altering the character of foul gases, by its peculiar properties. Mr. Turnbull, of Glasgow, in experimenting on the qualities of manure, covered 350 dead horses with charcoal, and no unpleasant odor was emitted from them. He also placed the body of a dog in a wooden box, for more than six months, in which he put a layer of charcoal, and covered it over with another layer, of a few inches in depth. The box was left uncovered in his laboratory, from which no offensive smell was ever discovered. The property of charcoal to restore sweetness to tainted meat was shown by Lowitz, when in St. Petersburg, in 1786.

[CIRCULARS.]

TO PATENTEES IN CANADA.

Gentlemen,

I beg to call your attention to the accompanying number of the *Journal of the Board of Arts and Manufactures* for Upper Canada, in which your patent is noticed among the list of Canadian Patents. You would confer an advantage on the general object of this journal, and facilitate the diffusion of a knowledge of your patent by forwarding to this office the specifications or a description for publication without any charge; and if suitable for the pages of the journal, any wood-cuts or stereotype plates which may serve to illustrate it.

I am, your obedient servant,

W. Edwards, *Secretary.*

TO MERCHANTS AND MANUFACTURERS.

Sir,

With a view to draw attention to Canadian Manufactures and to induce the public to give the preference to all articles of Canadian industry, I venture to call your attention to the excellent medium which the *Journal of the Board of Arts and Manufactures* now presents for making your manufactures more extensively known. Any communication relative to the subjects embraced in the following queries will be inserted in the Journal of this Board, whose pages will at all times be open to a description of the nature and extent of the manufactures in which you are engaged, and which you are respectfully invited to transmit to me for gratuitous publication, if found suitable to the pages of this journal.

I am, your obedient servant,

W. Edwards, *Secretary.*

1st.—What articles are you engaged in producing?

2nd.—What is the average number of hands in your employ; and their average wages?

3rd.—What amount of raw material do you consume; its nature and value, and where produced?

4th.—Were any of your men induced to emigrate to Canada to enter your employment? the number of their families?

5th.—How many families are dependent upon your establishment for subsistence?

6th.—What raw materials do you import; and what are produced in Canada?

7th.—Have you a Foreign or a Home Market for your Manufactures?

Mr. J. E. Pell, 14 Bonaventure Street, has consented to act as agent for this Journal in Montreal.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

MARCH, 1862.

THE FLOWING WELLS OF ENNISKILLEN, AND THE IMPORTANCE OF FINDING A MARKET FOR CANADIAN PETROLEUM IN EUROPE.

The successful tapping of the great subterranean sources of Petroleum in Enniskillen, has imparted a new and permanent interest to this extraordinary branch of industry and commercial enterprise. A great problem has been solved with respect to the sources of supply. Theoretically, the existence of deep-seated reservoirs of petroleum, occupying fissures and cavities in the rocks several hundred feet below the surface, has been predicted for some time past, but it was reserved for the energy and endurance of one or two individuals to prove their existence by actual and most successful experimental borings. Three "flowing wells" are now in operation, with a constancy and abundance of supply which surpasses the most sanguine expectations; and as yet we see but the beginning of these extraordinary fountains of oil, for there can be but little doubt that future borings in the vicinity of natural springs will reach the sources from which petroleum has been slowly oozing for centuries, perhaps for thousands of years, throughout the so-called oil region.

When the first petroleum spring was tapped at Titusville, Pennsylvania, in 1859, few persons conceived the vast importance of the discovery, or the astonishing commercial activity to which it would give rise in less than three years' time. In 1859, the Philadelphia and Erie Railroad carried 325 barrels of petroleum; in 1860 the amount swelled to 21,794 barrels, and in 1861 the seemingly enormous number of 134,927 barrels were transported along that line alone. This large quantity is exclusive of the supplies conveyed by the Atlantic and Great Western Railroad, and by the flat-boats, which float heavy cargoes to the Alleghany River, and thence to Pittsburgh. Large as these results appear to be, yet they fall into the shade when compared with the present yield, which in the Pennsylvania oil region is estimated at 75,000 barrels a month. No diminution has as yet been observed in the flowing wells; and so abundant and cheap is the yield from this source, that nearly all the pumping wells are now idle, and must probably continue so, unless the demand becomes greater than the flowing wells can supply at a very cheap rate.

The Canadian wells now rival those of Pennsylvania. The difficulty that the "oil men" have to contend with is to control the astonishing abundance of the yield, and to store it until a market can be found. The question of supply having been most satisfactorily solved, men are puzzled to know what to do with the treasure they have been so industriously seeking, now they have secured more than the most sanguine ever hoped for. The same energy and determination which sought and won it, must now be exerted to find a remunerative market for the unexpected and rather embarrassing abundance with which it has suddenly come upon them. The European markets alone are promising, and it is to Britain, France and Germany that they must look for aid to help them out of their present dilemma.

The question naturally arises, to what uses can petroleum be applied? We propose to glance at some of the most important practical applications of this abundant natural product, and shall endeavour to show that its general introduction for many purposes in the arts, merely requires time for its properties to become widely known, and the certainty of an unfailing supply firmly established in the minds of those who will become our largest consumers.

Before proceeding to enumerate the different uses to which petroleum can be applied, let us examine the nature of those products which can be obtained from it by destructive distillation.

The following analysis of Canadian petroleum was made by that distinguished practical chemist, Dr. Sheridan Muspratt, a notice of whose able chemistry, in its application to the arts, will be found on another page.

Dr. Muspratt finds 100 parts of Enniskillen oil to yield, upon distillation,

Light-colored naphtha (S. G. ·794)	20
Heavy yellow naphtha (S. G. ·837)	50
Lubricating oil, rich in paraffine	22
Tar	5
Charcoal	1
Loss	2
	100

The specific gravity of the crude oil is ·835, the standard of specific gravity required in England for the best petroleum being ·830.

The light-colored naphtha is the Benzole of the manufacturer. The heavy yellow naphtha is the illuminating oil.

The specific gravity of the Enniskillen oil is very nearly that of the standard. The Pennsylvania oil is considerably lighter, and does not yield so much illuminating oil on distillation. The Canadian oil contains considerably more paraffine than

the American, as might be expected from its greater specific gravity. An idea of the comparative value of the Enniskillen petroleum may be obtained by comparing it with Young's patent paraffine oil, of which not less than 8,000,000 gallons are yearly manufactured, chiefly from the distillation of the Boghead coal. Canadian petroleum is twenty-five per cent. (25 p. c.) better adapted for illuminating purposes than the crude oil from the Boghead coal. The royalty on each gallon of Boghead coal oil is 3d.; the price at which one gallon of the Enniskillen petroleum can be furnished is 2½c., or about equal to the royalty on the Boghead coal oil paid to Mr. Young for his patent, without the addition of the price of the coal, and all the expenses of the distillation of the oil. Under the disguised name of Belmontine oil, a vast quantity of petroleum illuminating oil is made in England from crude Burmese petroleum. It pays the enterprising proprietors of the Belmontine works to fetch from the far distant coast of Burmah the crude petroleum of that country. Will it not richly pay them to fetch the crude petroleum of Enniskillen? No doubt if they knew of the supply, and believed in its constancy, they would gladly seize the opportunities presented to them.

Its Use as a Burning Fluid,

The extraordinary cheapness of petroleum as an illuminator is too well known in Canada to require any special notice. Notwithstanding the comparative dearness in this country and the United States of the chemicals (sulphuric acid and alkalies) which are required to purify, deodorize, and fit it for burning in lamps, yet it is, at 45c. a gallon, incomparably the cheapest illuminator which has yet been manufactured; and it threatens, for domestic purposes, to drive all other means of illumination out of the field. But in Britain, France and Germany, where acid and alkalies are abundant and cheap, and where all the by-products—such as benzole, tar, &c.—can be utilized with profit, the preparation of purified petroleum can be effected at so much cheaper a rate than on this continent as to nearly make up the difference in the cost of the raw material which freight and insurance would add to it. We may then confidently look for the gradual introduction of petroleum as an illuminator throughout Britain and a large part of the continent of Europe, in rural districts where gas is not accessible.

The distillation of bituminous shales for burning purposes has long been practiced in France on a very extensive scale; as also the distillation of coal for the same object in the United States. Petroleum has arrested the production of coal oil or kerosene on this continent; it will soon arrest, if proper steps are taken, the production of shale oil in France and Germany. One ton of cannel coal produces from 50 to 100 gallons of crude coal oil;—the flowing wells in Enniskillen could yield, if they were allowed to pour forth their contents *ad libitum*, as much oil in 24 hours, at a nominal cost, as the distillation of 1,000 tons of cannel coal could be made to produce. The production of the valley of Bear Creek, in the Township of Enniskillen, is equal to 10,000 barrels a day if means of storage were in existence. In Northern Germany coal oils are very largely used for street illumination, on the railroads and most exposed localities. They are largely manufactured in Hamburg; but if crude petroleum were laid down in that city, at the cost at which it can be supplied from the Canada wells, freight, insurance and profit added, the manufacture of coal oils would cease. In Saxony and in Prussia the same results would follow; in order to obtain a cheap illuminator the bituminous shale oil works so common in those countries would be soon abandoned; for it must be borne in mind that such manufactures in Europe yield but small profits, even with all the skill and science of the German and French practical chemists.—The poor shales are cheap, the coals dear, and it is of the utmost importance to notice that, if crude petroleum were imported it would not occasion any material change in machinery, for the by-products are the chief sources of profit in Europe, all of which, in common with coal, petroleum is capable of producing. These products are—1st. Naphtha; used as a solvent for Caoutchouc, and different resins and gums. 2. Benzole; a valuable substitute for alcohol, ether and turpentine, it dissolves fats, and is largely used in woollen, cotton and silk manufactures; it restores faded colors; removes tar, paint, oils, grease and resin, and is the source of numerous dyes. 3. Illuminating oil; respecting which nothing further need be said. 4. Heavy lubricating oils; which, when mixed with a certain proportion of other fatty materials, are much used in Europe. 5. Napthaline. 6. Tar, which, when mixed with a certain proportion of crude oil, is used for the manufacture of gas, or when mixed with saw-dust, as stated hereafter, for fuel. 7. Refuse carbon; suitable for fuel, as shewn in the following paragraphs.

Its Use in the Manufacture of Gas.

Where coal is abundant and cheap it is not probable that in towns or cities gas manufactured from petroleum will be a successful competitor for public favour, notwithstanding its superior illuminating power and the agreeable softness of the light which it produces. The manufacture of gas from coal has attained such excellence that where the material can be procured at 6 shillings sterling

a ton, the value of the coke and other by-products is sufficient to pay all expenses, and many companies in England could afford to let their customers have the gas at a mere nominal price. But in districts where coal is dear and in large buildings not within reach of gas works, petroleum will become the cheapest source of illumination, and it has been satisfactorily shown in the city of Toronto that it can be manufactured with the utmost ease to burn without smoke or smell, and to give a light three times as brilliant as ordinary coal gas, and is capable of being produced at one half the cost. One gallon of petroleum, converted into gas by the process adopted in the works of Mr. J. E. Thomson of this city, produces more than 150 feet of gas possessing a very high illuminating power, a soft and agreeable light, with perfect immunity from smoke or smell. One gallon of petroleum weighs 8 lbs. 6 oz. and produces from 150 to 200 cubic feet of gas—a proportion considerably greater than that obtained from coal, even of the richest and best quality. Hence, there is every reason to believe that the manufacture of gas from petroleum will become general in large establishments, in rural districts, and in towns where coal is dear, not only in England but more particularly in France and many parts of Germany. In one town in Germany they manufacture gas from the fat they extract from soap suds, which are daily purchased throughout the town. It is easy to conceive that the crude petroleum of Canada would soon arrest this ingenious and expensive process.

As before remarked, a large number of patents have been taken out in France for the manufacture of patent fuel, and there can be no doubt that a very valuable if not an inexhaustible market may be found in France for the crude petroleum of Canada, so admirably adapted to form the means of utilizing combustible products which, without admixture with tar or similar substances, are wholly valueless. No doubt the facilities now presented for procuring an abundant and cheap supply of petroleum, would make numerous other products serviceable which are at present lost as waste, or bereft of half their value for the want of a medium to render them capable of being utilized.

Its Use as a Fuel.

Few but those who have visited France can form any idea of the high price of fuel in that country, or of the vast variety of methods which are employed to economize this necessary of life. Patents without number have been granted in France for the manufacture of "Artificial fuel." In order to explain this subject more thoroughly we subjoin one or two of the processes which are largely employed not only in Europe but also among the half civilized Orientals.

In the neighbourhood of the Caspian Sea, where petroleum springs are abundant, the inhabitants manufacture a fuel by impregnating clay with the combustible fluid; the clods are afterwards burned on an ordinary hearth. The Norwegians have long economized the sawdust of their mills by incorporating it with a little clay and tar and moulding it into the form of bricks. Of late years in England much attention has been given to artificial fuel in many districts, but not with much success, owing to the want of a suitable combustible, which petroleum is above all others best adapted to supply. In France charcoal is prepared from the refuse of the charcoal furnaces by mixing it with charred peat or spent tar and then adding tar or pitch. The materials are ground together and subjected to heat in close vessels to expel volatile gases. From seven to nine gallons of tar is mixed with two hundred weight of charcoal powder.

Gas used as fuel for culinary purposes is daily becoming more common in Europe. It is easy to understand why this source of fuel should be preferred where civilization and luxury have converted mere comforts into actual necessaries of life, which are always secured if money can purchase them. In rural districts, where common fuel is often very expensive, gas manufactured in portable works would be largely used for culinary operations, as it now is where the supply of gas is constant and cheap. But there is no necessity to convert petroleum into gas in order to use it as fuel. Stoves have been constructed for the combustion of this substance without the use of a glass chimney and without the production of smoke. It will necessarily, from its cheapness, supersede alcohol, which is commonly used as fuel for cooking purposes during the summer months. And we may soon look for its adoption as fuel for the generation of steam in our ocean steamers, where economy in bulk and weight is so great a desideratum. Petroleum is, at it were, the essence of coal, and the question of its adoption as a steam generator is dependent upon the abundance of the supply, to which a satisfactory answer has recently been given by the "flowing wells" of Enniskillen.

Its Use as an Antiseptic or Wood-preserver.

The cost of relaying the wooden ties and sleepers of railways is enormous. Our readers are familiar with Kyanizing and similar processes. Wood steeped in petroleum, or what is better, having petroleum forced into its pores by pressure, is proof against decay for many years.

Its Use as a Lubricator.

Even the crude oil is sought for with eagerness for this purpose in many workshops in England where swift motion is employed. When mixed with fat or resin it acquires greater consistency,

and it is more generally applicable to ordinary purposes, but it is the Lubricating oil which is one of the results of the destructive distillation of the crude product that is and will be most extensively used. Even should the heavy lubricating oil be not used for the purpose its name implies, the paraffine can be extracted by cold and pressure, and candles made from it, so that, under all circumstances, there is no waste or loss.

Enough has been said to show that the Enniskillen petroleum is admirably suited for many different purposes—as an illuminator, as a fuel, as material for the manufacture of gas, as a lubricator, an antiseptic, and to these may be added its use in the practice of medicine. We now turn to the difficulty and obstacles which oppose its introduction into the European market. At the beginning of this enquiry we are staggered by the fact that the present charge on the Great Western Railroad of Canada is, we are assured, three times as great for petroleum as for cattle. A car load of 55 barrels of oil from Wyoming to Toronto costs \$75—a car load of cattle from Windsor to the Suspension Bridge costs \$25, or ONE-THIRD the freight of the oil. It is of the highest importance that a reduction in freight should take place, or that a tramway from the springs to Lake St. Clair be constructed without delay. If it should be found advisable to make Toronto the port of discharge and thus escape the delays of the Welland Canal and cost of transport to Lake St. Clair, Railroad freight must come down, or it will be the interest of the "oil men" to make Lake St. Clair their point of departure for Europe.

It is of the highest importance that information respecting the nature and extent of the supply in Enniskillen should be widely distributed not only in England but in France and Northern Germany. Practical illustrations must be afforded the public in Europe that Canadian petroleum can do all that is promised for it. No better opportunity than the present could offer itself for effecting this object. A display of its properties, say in the manufacture of gas as being the most important, at the Great International Exhibition held at London the present year, would prove infinitely more valuable in making it generally known than any number of advertisements. We are assured that it is the desire of the Canadian Commissioners that the Canadian Department at the International Exhibition should be illuminated with gas manufactured from Enniskillen petroleum, and Mr. J. E. Thomson of Toronto will send one of his portable Petroleum Gas Retorts, with purifiers and gasometers complete for this purpose. The Canadian Commissioners could not have devised a better plan for directing public attention in England and elsewhere to this new and remarkable source of wealth to Canada. The illumination of the Canadian Department by this means will be attended with considerable expense, and if it should be beyond the limited resources of the Commissioners, no doubt the public spirit of private individuals will not be wanting in providing the necessary funds. Practical men like to see and judge for themselves. They receive with many doubts any statements which may be made without practical demonstration. Make petroleum gas before the practical men of Britain and they will believe their own eyes; tell them all that is true about it, without illustration, and they will turn the cold shoulder to statements not accompanied by practical results.

Some idea of the enormous interests at stake in the manufacture of illuminating oils from coal, shale and Burmese petroleum in Britain may be formed from the announcement made in evidence at a late trial, that during the year 1861 not less than 350,000 lamps for burning fluids were made by one firm alone. Paraffine oil, amongst other fluids, is sold at 3s. stg. a gallon to burn in these lamps, and if we assume that gas can be produced at 5s. per thousand, the cost of the light from the paraffine oil is 20 per cent. dearer than that of gas. But suppose that Canadian pretroleum could be laid down in England at 12d. sterling or 25 cents a gallon, petroleum light would be far cheaper than gas, the least expensive illuminator in England. Is not this universal field for enterprise a sufficient inducement for the "oil men" of Eniskillen to put their shoulders to the wheel and open for themselves a boundless market in England, France and Northern Germany? Sir Roderick Murchison, in his address on the progress of Geology, recently delivered at Manchester before the British Association, called attention to the "*important discovery of a resinous shale* in Tasmania termed Dysodile, which, like the Torbane mineral of Scotland, promises to be turned *to great account in the production of paraffine.*" We have the paraffine ready formed and associated with rich illuminating oils and other substances in our Canadian petroleum, which shows only two parts of waste in every hundred part by weight. Scottish Torbane mineral, Australian Dysodile, French bituminous shales, German lignites and Brown coal, Cuba and Porto Rico asphaltum must all give way before Canadian petroleum; how soon! depends upon the spirit, activity and energy of the Enniskillen 'oil men.' The markets of England, France and Germany are open to them if they will take steps to make their "treasures of oil" widely, thoroughly, and truthfully known to the manufacturers of Europe.

EXPLOSION OF A LOCOMOTIVE ON THE GRAND TRUNK RAILWAY.

The explosion of a locomotive on the Grand Trunk Railway, at the Queen Street crossing, near the Asylum, Toronto, on the morning of February 21st, was attended by some singular phenomena which are worth recording. All the details of this unfortunate catastrophe have been given in the daily papers, we shall therefore be content to notice some of the curious facts connected with the occurrence.

As regards the effect produced by the explosion itself, the most diverse opinions were formed by persons at different distances. One observer, at a distance of a mile and a half from the scene of the explosion, saw a column of steam suddenly shoot up, in the form of a pointed cone, to the height of about 400 feet, or considerably above the dome of the Lunatic Asylum, which from its neighbourhood afforded a fair means of comparison. As soon as the cone had attained that altitude it began to swell or expand, and finally assumed the form of a pear-shaped white cloud, which gradually dissolved from view. Persons living within half a mile from the spot thought that an earthquake had happened, the concussion was so violent. Doors were burst open, windows violently shaken, and the impression produced that the chimneys had suddenly fallen. At the distance of two miles, the report sounded like that produced by a piece of ordnance, and people turned round and looked in different directions to see where the noise proceeded from. In some instances it resembled a gun being fired in the neighbouring street, or in the yard attached to the house, or in a neighbour's yard, inducing people to go out and enquire the cause of the unusual explosion, apparently in their immediate vicinity. In other instances, persons quietly sitting in rooms on the upper story thought that some heavy object had fallen in the room below, and ran down stairs to see what was the matter. The effect produced upon the locomotive was most remarkable; the entire shell of the boiler, consisting of half inch plate, was torn into shreds like a piece of rotten cloth. The force appears to have affected equally every part of the boiler, as every part of the half inch plate, from the fire box to the smoke box, was similarly torn into shreds or large detached pieces, many of which were carried three and four hundred yards by the force of the explosion. Some of the copper tubes were bent, some torn off at one end and forced at an angle of 30 to 45 degrees in the air. All the screws of the fire box and smoke box appeared to retain their original position; the half inch plate had been torn from them. But perhaps the most singular effect produced was on the rails on which the locomotive stood. Those immediately under the driving wheels were indented and bent downwards to the depth of about one inch and a half. One of the rails was broken. The force seems to have been exerted in all directions, but much of its intensity appears to have been downwards, like the recoil of large pieces of ordnance. The driving wheels, after the explosion, were not more than a foot or eighteen inches from the deep indentation in the rails. The pressure of steam was not more than 100 lbs. to the square inch, and the steam would blow off at 120 lbs. In most cases of locomotive explosions the event happens at a stopping place, after some delay, and seems to occur just as the steam is turned on. In the present instance, as in many others of a similar character, the cause is apparently inexplicable if it be not ascribed to over pressure. No doubt this same locomotive has been hundreds of times in similar circumstances as regards pressure of steam (95 lbs. to the inch) at the commencement of motion, and yet no untoward event happened. While, however, if we accept the finding of the coroner's jury, we are justified in saying that, with our present knowledge of the conditions under which the locomotive was put in motion at the time, the explosion is inexplicable, we must bear in mind the results of long experience in England, as embodied in the late annual report of the Manchester Steam Boiler Association, extracts from which we subjoin as bearing upon these unfortunate occurrences. It may be well to state, however, that the evidence at the inquest tended to prove that a piece of bark was placed on the lever of one of the safety valve, so as to prevent it from acting; and in the opinion of several witnesses the explosion arose from over pressure. The jury exonerated the company and the engineer from all blame, and recommended the sufferers to the consideration of the company.

"The Manchester Association numbers 430 members, and had under inspection, in 1861, at 535 factories and other works, 1454 boilers and 1030 engines, representing approximately a total of 127,065 indicated horse power. No explosion had occurred to any boiler under the inspection of this Association during the past year, while no less than 20 explosions were known to have happened in various parts of the kingdom, from which 27 persons had been killed, 47 wounded, and considerable damage done to property. 5612 boiler inspections had been made, 52 boilers being found in a dangerous state; while, with regard to 226 others, it was necessary in 145 that the furnaces should be strengthened by hooping; in 52 that the shells should be strengthened by additional stays; and in 29 that the load on the safety valves should be reduced. The Association have been in the habit, on the occurrence of any explosion within a reasonable distance of Manchester, of having a special examination and report made upon the boiler in question, so that the members should have the advantage of the

information; and after alluding to the whole of the cases which have been examined in the course of the year, it was stated that it had been found that due care and periodical inspection, with the application, where necessary, of the hydraulic test, would have prevented every one of these explosions, and thus the word accident could not correctly be applied to any one of them. The report recommended the application of steam casings or jackets to cylinders, and the adoption of superheated steam, stating the commercial advantages derived from these arrangements in other parts of the country. After the adoption of the report, Mr. Bazley, M.P., moved the following resolution:—'That the meeting considers the system of voluntary periodical inspection to be worthy of the confidence of all steam users, and that this view is borne out by the fact that no explosion has occurred to any boiler under the inspection of this Association during the past year, while no less than twenty explosions are known to have happened in various parts of the kingdom. Also this meeting wishes promptly to call attention to the fact that in every case where exploded boilers have been examined and reported on directly to this Association, it has been found that the explosion resulted from the simplest causes, and might have been prevented by the exercise of due care. This meeting therefore considers that the labours of this Association have established the following principle, namely, that the causes of explosion have been shrouded in unnecessary uncertainty and mystery, and takes this opportunity of expressing its conviction that explosions are considered far too frequently to be accidental, and that by due attention to correct principles in the construction of boilers in the first place, added to care in their working in the second, the recurrence of explosions would be prevented.'

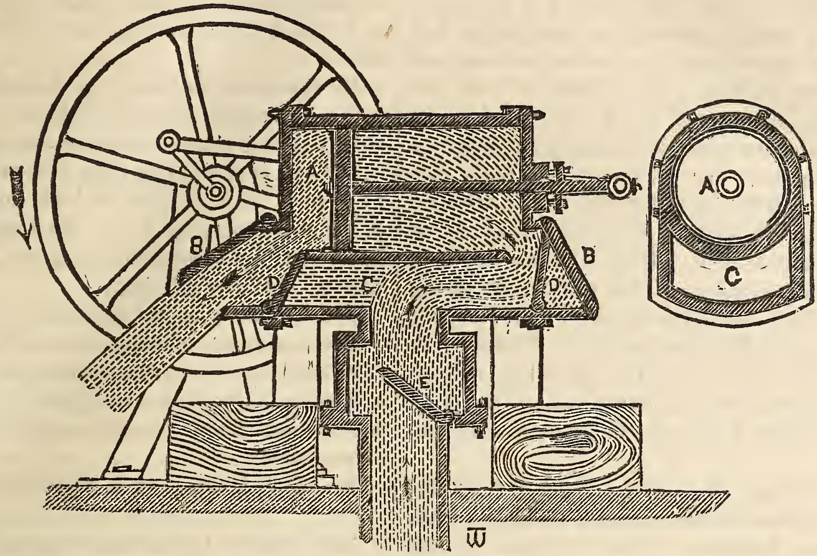
"At the last ordinary monthly meeting of the Executive Committee of this Association, held at Manchester, December 31, 1861, Mr. L. E. Fletcher, chief engineer, presented his monthly report, from which the following are brief extracts:—'During the past month 256 engines have been examined, and 364 boilers, 10 of the latter having been examined specially, 4 internally, 38 thoroughly, and 312 externally, in which the following defects have been found:—Fracture, 5 (1 dangerous); corrosion, 22 (3 dangerous); safety valves out of order, 9; water guages, 4; pressure guages, 2; blow-off taps, 13 (1 dangerous); fusible plugs, 5; furnaces out of shape, 6; total, 73 (5 dangerous). Boilers without glass water guages, 22; pressure guages, 4; blow-off taps, 18; feed back-pressure valves, 38. No explosion has happened to any boiler under the inspection of this Association during the past month, nor in fact throughout the whole year. A few cases of injury to furnaces have occurred, arising from deficiency of water consequent on the derangement of the glass water guages, which would have been prevented had there been two guages to each boiler, so frequently recommended. In another case, injury arose from the attendant lighting a fire in his boiler when empty, while, in another, from a defective blow-out tap. There has however come to my knowledge, in a casual way, the occurrence in various parts of the kingdom during the past year of no less than 20 explosions, from which 27 persons have been killed and 47 wounded, the boilers in question being of every variety—factory, colliery, marine, locomotive, agricultural, &c. Relative to economy in the raising and use of steam, I have brought before the attention of the members during the past year the importance of surface blowing out, and the advantage to be derived from the use of steam jackets, as well as from superheating. Surface blowing out is in very general use elsewhere, and found successful; it is not monopolised by patents, but is free to all. The use of steam jackets and superheated steam, aided by surface condensation (a subject on which I shall take an early opportunity of communicating with the members), are now working a perfect revolution in marine engine economy, and are extensively adopted by various large steam navigation companies. In the report of the last annual meeting of the Peninsular and Oriental Steam Navigation Company, the chairman stated that a new vessel called the Mooltan, of 2,600 tons burthen, having engines of 400 nominal horse power, in which the use of steam jackets and superheated steam had been adopted, the consumption of fuel had been reduced to rather less than one-half the usual amount; and the chairman added that the shareholders would readily perceive the importance of such a reduction in the consumption of fuel, when he reminded them that they had paid as much as £800,000 for coal in one year.'"

Atmospheric Disinfection.

Dr. Stenhouse, in a letter to the "Society of Arts Journal," says:—From time immemorial it has been a well-known practice to light large fires in marshy and other districts, in almost every quarter of the world, as it has been invariably found that this proceeding produced a very beneficial, though temporary effect on the salubrity of these districts. This result has hitherto been attributed to the influence of the heat evolved, by which a strong current of air is induced, and consequently, the stagnant atmosphere is set in thorough circulation. Now, however, that the absorbent and oxidising effects of charcoal on deleterious gases and vapours are so well understood and generally admitted, I think the true cause of the beneficial action of great fires in such situations is owing to the large quantity of minutely divided charcoal, which in the shape of smoke, is carried up into the atmosphere. These particles of charcoal absorb and destroy the deleterious gases. Since this is the case, I think it is clear that the object in these operations ought to be to make as much smoke as possible, and that green wood, or other moist fuel, will be found the more suitable for this purpose.

The British Navy.

An official return, issued under the authority of the Lords of the Admiralty, embodying full details relative to the condition and stations of the vessels of the British Navy has just been published. "The number of vessels in commission on the 1st of January was 856, of all rates and classes. There were, besides, 150 line-of-battle and other sailing ships stationed at the various ports in England and the colonies, for harbour duty, thus swelling the total to upwards of 1000 vessels of all descriptions. Of the 856 vessels actually in commission, or building or repairing for the service, only 154 are sailing ships, the whole of the remainder being propelled by steam power. The list of vessels is made up of 81 line-of-battle ships, each mounting from 74 to 131 guns; 22 vessels each with an armament of from 60 to 70 guns; 44 51-gun frigates, the whole, with the exception of about ten of that number, being screw steamers; 57 ships, each mounting from 22 to 50 guns, and the majority of which have a tonnage as large as ships of the line; 29 screw corvettes, or frigates, each mounting 22 guns, and 185 screw gunboats, each provided with two Armstrong guns.



THE PATENT DOUBLE-ACTIONED "FLOOD PUMP."

The following notice of this novel pump is from the *Mechanics' Magazine*, a deservedly popular monthly periodical published in London:—

Except for the purposes of a force-pump or fire-engine, the horizontal principle has not, we think, been applied with anything like a good practical result in the manufacture of pumps. Various applications of so desirable a motion have been made to the ordinary lift or bilge pump; but, from the fact of power being in all the instances required to drive out the water from the cylinder, from the misplaced position of the outlets, and the extreme difficulty, amounting almost to an impossibility, of getting to the valves—a fatal objection to a good working pump,—but little success has attended their introduction. These objections, however, have been removed in the double-actioned pump, illustrated in the accompanying sketch.

A shows cylinder, with a packed piston working through stuffing-box, motion to which is given by means of cross-head, parallel slings, crank, and fly-wheel. *BB* are the outlet valves, placed as low as possible in end covers of casting for egress of water by its own gravity, on "suction" being destroyed by reversal of stroke. *C* is a water-course entering cylinder by valves *D. E*, foot valve, the seating flanged on as shown, the valve-box, water-course, and cylinder, being all one casting. The end covers of the casting are also flanged on, by which means access may be readily had to the piston; while access to the valves *D* is obtained by simply raising or lifting off the outside valves *B*.

This is a pump, in the use of which stoppage is rendered very difficult, all the working parts being as it were on the surface, and under immediate control; while, as a ship's pump, it is of importance, bearing in mind the repeatedness with which ships, having valuable cargoes, have been abandoned owing to the inefficiency of the pumps, from their tendency to get choaked, and the impos sibility, from the position of their working parts, of keeping them clear.

A small pump of 4-inch bore, with a 6-inch stroke, worked by a man at 45 revolutions of the wheel a minute, discharged, from a well 16 feet from the surface, a quantity of water equal to 1,455 gallons per hour, being within a fraction of the measured capacity of the cylinder filled twice every revolution: while a pump with a 12-inch cylinder and 18-inch stroke, with two men making 30 revolutions per minute, is capable, it is stated, of discharging, within the hour, 26,400 gallons; a result that cannot be arrived at with the ordinary two-barrel contractor's pump, with about four times the amount of power in the same time.

THE PORT DOVER WOOLLEN FACTORY.

The factory is located in the town of Port Dover, on Patterson's Creek, a short distance above its junction with Black Creek, the stream being navigable for ordinary lake crafts from the lake to a point near the buildings. The fall of water obtained is about thirteen feet (13), and the stream a most durable one, affording ample power, not only for all the machinery the buildings will contain, but leaving a large amount of power available for any other business. The mill is a frame building 90x50, of four stories, each one twelve feet high, and an attic, the whole covered with shingles laid in mor-

tar. At the south end, and attached to this main building, is another structure of wood thirty feet square, two stories high. On the east, and attached to this latter building is a dye house 30+35, one story high, both covered with a felting and gravel roof. On the north end of the main building is a brick attachment 25+30, two stories high, also covered with a felting and gravel roof. Attached to the north side of this is a drying house 110+25, two stories high. It is a frame building covered with shingles. At the extreme north end of the drying house is the chimney, built of brick, fifty feet high. The foundations of all these buildings are piles, driven into the ground to a depth of sixteen feet, with oak timber laid on the piles, and a stone wall five feet high built on these timbers.

The building on the extreme south end, 30 feet square, contains the water wheel, which was made by Messrs. Kelbourn, Lincoln & Son, of Fall River, Mass., and is a Turbine wheel, 68 inches in diameter, and is of sufficient power to drive seven complete setts of machinery for the manufacture of woollen goods. This flat also contains turning lathe, work bench, etc., and the scouring tub and rinse box. The second flat is for sorting wool into the different qualities, and contains bins for wool. The building east of this, 30+35, is a dye house, with ample dye vats.

The main building, on the first flat, contains the fulling mills, giggs, presses, shearing and brushing machines.

The second flat contains, at present, six narrow and four broad Crompton looms, of the most improved construction, and contains ample room for forty looms.

The third flat contains two complete setts of carding machines, card grinder, and three jacks of two hundred and forty spindles each.

The fourth flat is not used at present, but is intended for the spinning room.

The attic contains the picker and duster and the gauze room, and bins for storing wool, with spouts running down for the conveyance of the wool to the carding machines. The gauze room is fire proof.

The brick structure at the north end of the main building contains, in the first flat, a steam boiler, and a hot water tank, and a force pump for supplying water to the boiler, and a blue vat.

The upper story contains spoolers and warping machines.

The long building, 110+25, contains, on the first flat, wool racks for drying wool; the second flat, twelve bars for drying cloth; it is heated by the smoke pipe, which is made of iron 22 in. in diameter, and running the entire length from the boiler to the brick chimney in the rear, a distance of 110 feet.

All the other buildings are heated by steam pipes, so arranged that the whole or only any particular portion can be heated, as may be desired.

The dye vats, scouring tubs, etc., are all heated by steam. An iron pipe also leads from the boiler to the gauze room, by which the steam from the boiler can be conveyed into the gauze room to extinguish fire, should it occur.

The machinery in the buildings is only about one-third they are capable of containing.

In addition to the several structures mentioned, a storehouse, 50x30, two stories high, is erected at a distance of 120 feet from the other buildings, for storing wool.

The whole is leased by J. N. Pett, Esq.

THOS. FOGG'S IMPROVED BALLASTING CAR, FOR RAILWAY AND OTHER PURPOSES.

The complete, economical, and expeditions unloading of ballast has hitherto proved a practical difficulty, of which numerous experiments have been tried and repeated failures encountered.

It is believed that the application of "Fogg's Patent Ballast Car" will be found a remedy for defects that have arisen from imperfectly constructed cars.

The object of this invention is to equalize and distribute the gravel inside and outside the railway track, as required, and to do away entirely with the gang of men that is necessary in the present cars.

In Mr. Fogg's Patent Car there are no men required but the two brakesmen and the conductor, as two men can unload a train of ten cars in from five to eight minutes. The cars are constructed to hold eight cubic yards, and, as stated by the inventor, can be unloaded one yard at a time, and put either inside or outside the railway track, or the whole can be unloaded at once.

In the present cars there is in some places from 50 to 100 per cent. of the ballast lost down the embankment, as the whole of the ballast has to be unloaded on the outside of the track, and then to be shoveled in on the inside of the track again, whereas in this Patent Car it is equally divided inside and outside the railway track, and saves the labour that is required to shovel it in the inside of the track, probably from 10 to 20 per cent. in the saving of Ballast, and if the embankment is only 18 inches from the rail no pebbles will go down the embankment.

It will take 18 or 20 men, 40 or 50 minutes to unload a train of 10 cars, that is the present flat

cars, those men are now entirely dispensed with, as the two brakesmen can, it is said, unload the same number of the Patent Cars in from 5 to 8 minutes.

Mr. Fogg's improvement possesses the advantages of simplicity, compactness, less expense and is not liable to get out of order. The present Flat Cars can be altered at a small expense if required. So it will be thereby seen that Mr. Fogg's Car will do away with:

In unloading....	Manual labour.
In locomotive power......	From 20 to 30 per cent.
In ballast....................	From 10 to 20 per cent.
In time........................	From 20 to 30 per cent.

Still further it is adapted to the common horse waggon, for moving earth, gravel, or other loose material, as a waggon box can be constructed on the same principle, at a small expense, so that the driver can unload the waggon himself without stopping his horse or moving from his seat. Any information with regard to the invention may be obtained from Mr. Thomas Fogg, Brantford, C. W.

PROGRESS OF GEOLOGY.*

Although I have had the honour of presiding over the Geologists of the British Association at several previous meetings since our first gathering at York, now thirty years ago, I have never been called upon to open the business of this section with an address; this custom having been introduced since I last occupied the geological chair at Glasgow, in 1855.

The addresses of my immediate predecessors, and the last anniversary discourse of the President of the Geological Society of London, have embraced so much of the recent progress of our science in many branches, that it would be superfluous on my part to go again over many topics which have been already well treated.

Thus, it is needless that I should occupy your time by alluding to the engrossing subject of the most recent natural operations with which the geologist has to deal, and which connect his labors with those of the ethnologist. On this head I will only say, that, having carefully examined the detrital accumulations forming the ancient banks of the river Somme in France, I am as complete a believer in the commixture in that ancient alluvium of the works of man with the reliquiæ of extinct animals as their meritorious discoverer, M. Boucher de Perthes, or as their expounders, Prestwich, Lyell, and others. I may, however, express my gratification in learning that our own country is now affording proofs of similar intermixture both in Bedfordshire, Lincolnshire, and other counties; and, possibly, at this meeting we may have to record additional evidences on this highly interesting topic.

But I pass at once from any consideration of these recent accumulations, and, indeed, of all Tertiary rocks; and, as a brief space of time only is at my disposal, I will now lay before you only a concise retrospect of the progress which has latterly been made in the development of one great branch of our science. I confine myself, then, to the consideration of those primeval rocks with which my own reseaches have for many years been most connected, with a few allusions only, to metamorphism, and certain metalliferous productions, &c.

There is, indeed, a peculiar fitness in now dwelling more especially on the ancient rocks, inasmuch as Manchester is surrounded by some of them, whilst, with the exception of certain groups of erratic blocks and drifts, no deposits occur within the reach of short excursions from hence, which are either of Secondary or Tertiary age.

Let us, then, take a retrospective view of the progress which has been made in the classification and delineation of the older rocks since the Association first assembled at York, in 1831. At that time, as every old geologist knows, no attempt had been made to unravel the order or characters of the formations which arise from beneath the Old Red Sandstone. In that year Sedgwick was only beginning to make his first inroads into those mountains of North Wales, the intricacies of which he finally so well elaborated, whilst I only brought to that, our earliest assembly, the first fruits of observations in Herefordshire, Brecon, Radnor, and Shropshire, which led me to work out an order which has since been generally adopted.

At that time the terms of Cambrian, Silurian, Devonian, and Permian, were not dreamt of, but, acting on the true Baconian principle, their founders and their coadjutors have, after years of toil and comparison, set up such plain landmarks on geological horizons that they have been recognized over many a distant land. Compare the best map of England of the year 1831, or that of Greenough, which had advanced somewhat upon the admirable original classification of our father, William Smith, and see the striking difference between the then existing knowledge and our present acquirements. It is not too much to say that, when the British Association first met, all the region on both sides of the Welsh border, and extending to the Irish Channel on the west, was in a state of dire confusion; whilst in Devonshire and Cornwall many of these rocks which from their crystalline nature were classed and mapped as among the most ancient in the kingdom, have since been shown to be of no higher antiquity than the Old Red Sandstone of Herefordshire.

As to Scotland, where the ancient rocks abound, though their mineral structure, particularly in those of igneous origin, had necessarily been much developed in the country of Hutton, Playfair, Hall, Jameson, and McCulloch, yet the true age of many of its sedimentary rocks and their relations were unknown. Still less had Ireland, another region mainly palæozonic, received any striking portion of that illustration which has since appeared in the excellent general map of Griffith, and which is now being carried to perfection through the labors of the geological survey under my colleague Jukes. If such was our benighted state as regarded the order and character of the older formations at our

* Thirty Years Retrospect of the progress in our knowledge of the Geology of the Older Rocks—being an Address to the Geological Section of the British Association at Manchester, Sept. 5, 1862; by Sir Roderick Impey Murchison, D.C.L., LL.D., F.R.S., Director General of the Geological Survey of the United Kingdom, President.

first meeting, great was the advance we had made when at our twelfth meeting we first assembled at Manchester in 1842. Presiding then as I do now over the geological section, I showed in an evening lecture how the palæozoic rocks of Silurian, Devonian, and Carboniferous age, as well as those rocks to which I had assigned the name of Permian, were spread over the vast region of Russia in Europe and the Ural Mountains. What, then, are some of the main additions which have been made to our acquaintance with the older rocks in the British Isles since we last visited Manchester?

Commencing with the oldest strata, I may now assume, from the examination of several associates on whose powers of observation as well as my own I rely, that what I asserted at the Aberdeen meeting, in 1859, as the result of several surveys, and what I first put forth at the Glasgow meeting of 1855, is substantially true. The stratified gneiss of the northwest coast of the Highlands, and of the large island of Lewis and the outer Hebrides, is the fundamental rock of the British Isles, and the precise equivalent of the Laurentian system of Canada, as described by Sir W. E. Logan. The establishment of this order, which is so clearly exhibited in great natural sections on the west coast of Sutherland and Ross, is of great importance in giving to the science we cultivate a lower datum-line than we previously possessed, as first propounded by myself before the British Association, in 1855.*

For hitherto the order of the geological succession, even as seen in the geological map of England and Wales or Ireland, as approved by Sir Henry De la Beche and his able coadjutors, Phillips, Ramsay, Jukes, and others, admit no older sedidiment than the Cambrian of North Wales, whether in its slaty condition in Merioneth and Caernarvon or in its more altered condition in Anglesea.

The researches in the Highlands have, however, shown that in our own islands, the older palæozoic rocks, properly so called, or those in which the first traces of life have been discovered, do repose, as in the broad regions of the Laurentian Mountains of Canada, upon a grand stratified crystalline foundation, in which both limestones and iron-ores occur subordinate to gneiss. In Scotland, therefore, these earliest gnessic accumulations are now to be marked on our maps by the Greek letter *alpha*, as preceding the Roman a, which had been previously appied to the lowest known deposits of England, Wales, and Ireland. Though we must not dogmatise and affirm that these fundamental deposits were in the pristine state absolutely unfurnished with any living things (for Logan and Sterry Hunt, in Canada, have suggested that there they indicate traces of the former life), we may conclude, that in the highly metamorphosed condition in which they are now presented to us in North Western Britain, and associated as they are with much granitic and hornblendic matter, they are for all purposes of the practical geologist "azoic rocks." The Cambrian rocks, or second stage in the ascending order as seen reposing on the fundamental gneiss of the North West of Scotland, are purple and red sandstones and conglomerates forming lofty mountains. These resemble to a great extent portions of the rocks of the same age which are so well known in the Longmynd range of Shropshire, and at Harlech in North Wales, and Bray Head in Ireland.

At Bray Head they have afforded the Oldhamia, possibly an Alga, whilst at the Longmynd, in Shropshire, they have yielded to the researches of Mr. Salter some worm-tracks and the trace of an obscure crustacean.

The Highland rocks of this age, as well as their equivalents, the Huronian rocks of North America, have as yet afforded no trace whatever of former life. And yet, such Cambrian rocks are in parts of the Longmynd, and especially in the lofty mountains of the North Western Highlands, much less metamorphosed than many of the crystalline rocks which lie upon them. Rising in the scale of successive deposits, we find a corresponding rise in the signs of former life on reaching that stage in the earlier slaty and schistose rocks in which animal remains begin clearly to show themselves. Thus, the Primordial Zone of Mr. Barrande is, according to that eminent man, the oldest fauna of his Silurian Basin in Bohemia.*

In the classification adopted by Sir Henry de la Beche and his associates, the Lingula Flags (the equivalent of the "Zone Primordial" of Barrande) are similarly placed at the base of the Silurian System. This Primordial Zone is also classed as the Lowest Silurian by De Verneuil, in Spain; by James Hall, Dale Owen, and others, in the United States; and by Sir W. E. Logan, Sterry Hunt, and Billings, in Canada.†

(*To be continued.*)

Cornish Engines.

The average duty of twenty-eight Cornish pumping engines, reported for August, was 51,200,000 lb., lifted 1 ft. high by the consumption of 112 lb. coal, the duty being equal to $4\frac{1}{2}$ lb. coal per actual (not indicated) horse power per hour.

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* See Reports of British Association for 1855 (Glasgow Meeting) At that time I was not aware that the same order was developed on a grand scale in Canada, nor do I now know when that order was there first observed by Sir W. E. Logan. I then (1855) simply put forward the facts as exhibited on the northwest coast of Scotland, viz.. the existence of what I termed a lower or "fundamantal gneiss," lying far beneath other gneissose and crystalline strata, and containing remains which I even then suggested were of Lower Silurian age. Subsequently, in 1859, when accompanied by Professor Ramsay, I adopted, at his suggestion, the word "Laurentian," in compliment to my friend, Sir William Logan, who had then worked out the order in Canada, and mapped it on a stupendous scale. I stated, however, at the same time, that, if a British synonym was to have been taken, I should have proposed the word "Lewisian," from the large island of the Lewis, almost wholly composed of this gneiss.

* I learn, however, that in Bohemia, Dr. Fritsch has recently discovered strata lying beneath the mass of the Primordial Zone of Barrande, and in rocks hitherto considered azoic, the fossil burrows of annelide animals similar to those of our own Longmynd.

† In completing at his own cost a geological survey of Spain, in which he has been occupied for several years, and in the carrying out of which he has determined the width of the sedimentary rocks of the Peninsula (including the Primordial Silurian Zone, discovered by that zealous explorer, M. Casiano de Prado), M. de Verneuil has in the last few months chiefly examined the eastern part of the kingdom where few of the older palæozoic rocks exist. I am, however, informed by him, that Upper Silurian rocks with *Cardiola Interrupta*, identical with those of France and Bohemia, occur along the southern flanks of the Pyrenees, and also re-occur in the Sierra Morena, in strata that overlie the great mass of Lower Silurian rocks as formerly described by M. Casiana de Prado himself. The southern face of the Pyrenees, he further informs me, is specially marked by the display of mural masses of Carboniferous strata, which, succeeding the Devonian rocks, are not arranged in basin-shape, but stand out in vertical or highly inclined positions, and are followed by extensive conglomerations and marls of Triassic age, and these by deposits charged with fossils of the Lias.

Board of Arts and Manufactures

FOR UPPER CANADA.

PHILP'S PATENT MARINE DROP.

Our advertising columns contain testimonials of Masters of Vessels as to the value of an invention by Mr. Philp, of Cobourg, of a mode of unhooking boats from the davits of sailing vessels or steamboats, of which the following is a description:—

A lever works under the middle shaft of the boat, connected to an upright shaft which passes through an iron plate about six inches long, in the bottom of the boat; to each end of this plate is affixed an iron rod, passing through two eyebolts at each end of the boat, and to which is attached a link for balancing or keeping the boat on an even keel.

By lowering the boat to within three or four feet of the water, and giving the lever a slight pull, it draws the rods out of the further eyebolts into those nearest the plate, leaving the hooks clear, and the boat drops into the water. By putting the lever back every thing is ready for hooking again, which one man can accomplish with ease.

RULES FOR THE DISTRIBUTION OF THE PRIZES AT THE INTERNATIONAL EXHIBITION.

The following are the rules according to which the prizes will be awarded:—

"An international jury will be formed for each class and sub-class of the Exhibition, by whom the medals will be adjudged.

"Each foreign commission will be at liberty to nominate one member of the jury for each class and sub-class in which staple industries of their country and its dependencies are represented.

"The names of the foreign jurors must be sent to Her Majesty's Commissioners before the 28th of February, 1862.

"The British jurors will be chosen in the following manner:—Every exhibitor will name three persons to act on the jury for each class or sub-class in which he exhibits, and from the persons so named, Her Majesty's Commissioners will select three members of the jury for each such class or sub-class.

"Her Majesty's Commissioners reserve to themselves the power of modifying thsee arrangements in any particular case where it may appear to them that the strict application of the principles of these decisions would be attended with injustice.

"The names of the jurors will be published in March, 1862.

"The juries will be required to submit their awards, with a brief statement of the grounds of each, to Her Majesty's Commissioners, before the last day of May, 1862.

"Should the reasons assigned for any award appear insufficient, or should no reasons be given, Her Majesty's Commissioners reserve to themselves the right ef confirming or rejecting it.

"The awards will be published in the Exhibition building, at a public ceremony, early in the month of June, 1862.

"They will immediately afterwards be conspicuously attached to the counters of the successful exhibitors, and the grounds of each award will be very briefly stated.

"If an exhibitor accepts the office of juror, no medal can be awarded in the class or sub-class to which he is appointed, either to himself individually or to the firm in which he may be a partner.

"The medals will be delivered to the exhibitors on the last day of the exhibition."

A SUPPLEMENTARY INTERNATIONAL EXHIBITION COMPANY.

It is proposed to establish an International Supplementary Exhibition Company, for the purpose of affording room for productions which cannot be accommodated in the great Exhibition of 1862, and to furnish means for the sale of articles exhibited at either place. The building is to be completed for opening on the 15th of May. The charge for space will be 12s. per square foot for the floor, and 6s. for the walls, being less than one-half of the annual rental of the London bazaars, and the period will be from the 15th of May to the end of October, The design and supervision of the structure will be by Sir Joseph Paxton, and the trustees are Sir Robert Carden, Alderman Finnis, and Mr. William Jackson, M.P. The company, before taking any steps, ascertained that the project would not be objected to by the Royal Commissioners of the Great Exhibition.

CANADIAN PATENTS.

Bureau of Agriculture and Statistics, Quebec, 20th February, 1862:—

James W. McLaren, of Lowville, in the County of Halton, "An improved feed gear for Straw Cutters."—(Dated 26th November, 1861.)

Alex. Solomon Wallbridge, of Bedford, in the County of Mississquoi, Carpenter, "An improved mode of operating variable expansion steam cut off Valves."—(Dated 28th November, 1861.)

Lewis Comer, of the Township of Hinchinbrook, in the county of Frontenac, Mechanic, "An improved Bee-Hive."—(Dated 29th November, 1861.)

William Chambers, of London, in the County of Middlesex, Engineer, "An improved Carriage Hub."—(Dated 29th November, 1861.)

Augustus E. Taylor, of the Town of Brockville, in the County of Leeds, "An improved Door Bell."—(Dated 29th November, 1861.)

Henry Lawson, of the Town of Peterborough, in

the County of Peterborough, "A combined Retort for generating Gas from Carbon Oil."—(Dated 29th November, 1861.)

Thomas Blanton, of Drummondville, in the County of Welland, Carpenter and Joiner, "An improved Broad-Cast Seed-Sower and Drag."—(Dated 29th November, 1861.)

William McDougall, of the Township of York, in the County of York, "A self acting Brake for Sewing Machines."—(Dated 29th November, 1861.)

Thomas Wm. Harper, of the Town of Cobourg, in the County of Northumberland, Turner, "A new Wash Tub."—(Dated 29th November, 1861.)

Edwin R. Langs, of the Township of Brantford, in the county of Brant, Farmer, "A portable and substantial Fence-post and Fence."—(Dated 29th November, 1861.)

Philip Cady Van Brocklin, of the town of Brantford, in the county of Brant, Iron Founder, "An improved combined Grain Drill, Cultivator and Horse Hoe."—(Dated 29th November, 1861.)

Thomas Worswick, of the town of Guelph, in the county of Wellington, Engineer, "An improved Switch for Railroads."—(Dated 29th November, 1861.)

Etienne Henri Parent, of the city of Quebec, Civil Engineer, "For the introduction into Canada of a French invention known as "Air Expansion Motive Power produced by the combustion of Gases, by means of the Electric Spark."—(Dated 30th November, 1861.)

Edward D. Ashe, Lieutenant in Her Majesty's Navy, "A new and improved method of constructing Steam Engines, to be called 'Shaft Engines.' "—(Dated 2nd December, 1861.)

Harry Seymour, of the city of Montreal, Gentleman, "A composition to be named Seymour's Concentrated Fuel.—(Dated 2nd December, 1861.)

John Fleming, of Petrolia, in the county of Lambton, Engineer, "A double Acting Still."—(Dated 4th December, 1861.)

Masa Branch Southwick, of Mont St. Hilaire, in the County of Rouville, Manufacturer of Wool and Flax dressers, "A new and useful machine for separating shives, chaff and dust from the Tow of Flax, Hemp &c., to be called 'Southwick's Tow Cleaner.' "—(Dated 5th December, 1861.)

James Dougall, of the parish of Montreal, Engineer, "A composition of matter for the packing of axle boxes of Locomotive Engines, tenders and railway cars."—(Dated 5th December, 1861.)

Matthew Henry, of the township of Compton, in the County of Compton, Cabinet maker, 'A new Plough, to be called Henry's Complete Plough."—(Dated 9th December, 1851.)

Matthew Henry, of the township of Compton, in the County of Compton, Cabinet maker, "An improved Fanning Mill."—(Dated 9th Dec., 1861.)

William Franklin Hutchins, of the city of Montreal, Machinist, "A Rivet Machine."—(Dated 10th December, 1861.

Thomas H. Hoskings, of the city of London, in the county of Middlesex, Machinist, "A new machine for obtaining Rotary Motion for driving Machinery."—(Dated 16th December, 1861.)

James Howell, of the township of Dereham, in the County of Oxford, Moulder, "An Iron Die for moulding and casting Plough-shares."—(Dated 16th December, 1861.)

William Mohaffy, of the Town of Brampton, in the County of Peel, Blacksmith, "An improved Plough."—(Dated 16th December, 1861.)

Hugh N. Shaw, of Cooksville, in the County of Peel, Merchant, "An improved Dome Petroleum Separator."—(Dated 16th December, 1861.)

Stillman Ray, of the Township of Stanstead, in the County of Stanstead, Mechanic, "Ray's improved Tub and Pail Machine."—(Dated 18th December, 1861.)

George H. Meakins, of the city of Hamilton, in the County of Wentworth, Sewing Machine Maker, "A combined Universal Hemmer and Binder."—(Dated 26th December, 1861.)

James Tomlinson, of the Township of Pickering, in the County of Ontario, Mechanic, "A Bevelled Sawn Hoop."—(Dated 27th December, 1861.)

Samuel S. Martin, of the city of Toronto, in the county of York, assignee of John Angell Cull, the assignee of Edward Lefroy Cull, the Inventor, 'Auxilliary Spring Improvement for Sewing Machines."—(Dated 27th December, 1861.)

George Charters Keachie, of the town of Brantford, in the county of Brant, Gaoler, "An improved Strapless Skate."—(Dated 27th December, 1861.)

ABRIDGED SPECIFICATIONS OF ENGLISH PATENTS.

Full specifications of all English patents issued may be obtained on application to Bennet Woodcroft, Esq., Great Seal Patent Office, 25 Southampton Building, Holborn, London ; the price of which —varying from 3d. to 5s. sterling—must be remitted by Post Office order, made payable at the Post Office, Holborn.

Lists of all specifications may be seen at the Free Library of Reference of the Board of Arts and Manufactures, Toronto, as published in the Commissioner of Patents Journal.

1328. M. de Albytre—*Improvements in tallow candles, called "Helioclypse candles."* Dated May, 27, 1861.

In carrying out this invention the patentee takes say 112 pounds of tallow, and melts by steam, water baths or open fire, giving preference to the two latter methods ; and when it has been fused, he adds about 13 ounces of alumina, precipitated by ammonia. He then pours in about 1½ ounces of spikenard (lavendula spica), but other essences may be used if preferred. He heats about forty minutes, taking care to keep constantly stirring in order to divide or separate the alumina, and cause it to combine with the tallow. He then adds about 20 ounces of chloride of zinc, which must be perfectly white, and it is prepared in an alembic or matrass, in which zinc cut into very small pieces is placed in a sufficient quantity of acid to dissolve it. To this he adds about 20 ounces of chloride of lead, boiled or in pulp, and then the same quantity of solid chloride of zinc. He then continues to heat for from 40 to 45 minutes, being scrupulously careful to keep constantly stirring the mass with a spatula. He removes the composition from the fire when the scum is nearly black, and the dissolution of the matters complete. He then pours the mass into a trough or tub, or by preference into a

glazed earthen pan, well stirring, after which he allows it to rest until he desires to pass it into the moulds. When he is manufacturing candles of 6 to the pound, he uses from 20 to 23 threads for the wick, and for those of 5 to the pound from 28 to 34 threads. By these means he obtains candles, one pound of which will give light for 80 to 85 hours, and which, while in whiteness and consistence almost equal wax, will not cost more than the commonest candles now made.

1442. R. Harlow.—*Improvements in the fire-bridges and tubes of steam boilers, and in the manner of applying the same.* Dated June 7, 1861.

The patentee claims the application and adaptation of a fire or water space bridge to boilers for the generation of steam (constructed after the manner as described), and composed of a series of small thin tubes, with the various modes of connecting the same with the upper and lower bodies of water in a steam boiler. And as regards the fixing of tubes in the interior of flues of cylindrical boilers, he claims only the application and adaptation of two or more portable or movable tubes to the flues of steam boilers, whereby they may readily have their powers increased, and the circulation improved, and the flues materially strengthened.

1507. J. Watt.—*An improved mode of converting vegetable fibrous substances into pulp.* Dated June 12, 1861.

This invention relates to a peculiar mode or process for converting vegetable fibrous substances into pulp, and consists in subjecting the vegetable fibrous substances to the action of proto-carbonate of soda, or bicarbonate of soda, or proto-carbonate of potassa, or of potassa, bicarbonate of soda, or soda ash, in solution in water, by heating the whole to the boiling point, and boiling the same until the fibrous substance has been so acted upon that, on being washed and treated with an aqueous solution of chloride of lime or chloride of soda, it is converted into pulp.

1543. T. Gray.—*A new method of bleaching coloured rags and vegetable fibres.* Dated June 17, 1861.

The patentee claims the steeping and immersion of the substances to be bleached in a solution of muriatic acid and water, previously to their being submitted to the action of bleaching liquor.

1548. T. Routledge.—*Improvements in the manufacture of paper.* Dated June 17, 1861.

This consists in the preparation of half-stuff (paper pulp) and paper from Esparto or Spanish grass (comprising spartum lignum, stipa terracissima, dis or alfa), the same being applicable to straw and other raw fibrous substances. The general details of the process are the same as specified in a patent (No. 274.) dated 2nd February, 1860, the improvement consisting in that portion which relates to the preparation of the leys employed in boiling Esparto or other raw fibres, and in order to preclude the presence of lime in the caustic state, or even to much causticity in the leys.

1578. J. Faulding.—*Improvements in locomotive engines.* Dated June 19, 1861.

This consists in so combining the mechanical parts of a locomotive engine that all the momentum resulting from the working of the various parts of the engine shall be on the longitudinal central line of the locomotive. To effect this object the patentee places the two cylinders of the locomotive at right angles to each other or thereabouts, and unites the connecting rods of each to one central crank pin on the driving axle.

1852. J. Cullen.—*Improvements in preserving wood and iron.* Dated June 19, 1861.

Here a composition, consisting of coal tar, quick-lime, and charcoal, is used. The charcoal is reduced to a fine powder, and such is the case with the quick-lime; these materials are to be well mixed together and subjected to heat. To preserve wood, the composition is heated, and the wood is immersed therein.

1591. R. A. Broomen.—*Improvements in pianofortes, parts of which improvements are applicable to other musical instruments and to apparatuses worked by pedals.* (A communication.) Dated June 20, 1861.

One of the great drawbacks to the perfection of the pianoforte as a musical instrument is the non-continuity of the sound, which, owing to the arrangement of the hammer, only lasts a stated time. To overcome this defect the inventor adds to the instrument an arrangement somewhat similar to the bow of a violin, which he causes to act separately or simultaneously with the hammer. To the intermittent percusive he adds a continuous action, and produces continuous sounds without in any way lessening the effects usually produced in pianofortes.

1633. M. A. F. Mennons.—*A new or improved construction of caloric engines.* (A communication.) Dated June 26, 1861.

This invention consists in a new or improved combination of known machinery applied to the construction of locomotive, stationary, marine, and other engines. The essential elements of this combination, in which heated air is the motive agent, are:—1. A ventilating apparatus, by means of which cold air is thrown into the body of the engine. 2. A furnace, composed of a metallic cylinder, provided with a horizontal grate carrying the fuel, with vertical grated apertures, giving passage to the air supplied by the ventilator. 3. A turbine, mounted on a horizontal shaft, and driven by the dilated air mingled with the gaseous products of the combustion. 4. A regenerating apparatus, by means of which the cold air supplied by ventilator is progressively heated to a given point, while the temperature of the hot air escaping from the turbine is reduced in the same proportion.

1679. J. G. Wilson.—*Improvements in the means or apparatus employed for feeding steam boilers with hot water.* Dated July 2, 1861.

This consists in the application of a valve to the said tubes or feeding apparatus, so arranged and connected with the boiler that, when the pump ceases to force the water through the tubes, the valve will open to the water in the boiler, and allow it to circulate in the tubes, and thus prevent explosion or damage to the tube.

1694. J. Petrie.—*Improvements in machinery or apparatus for washing and drying wool, cotton, and other fibrous materials requiring similar treatment.* Dated July 3, 1861.

This refer, 1, to a method of driving such fee aprons of machines for washing wool, &c., as a

caused to travel by rollers, which act independently of those over which the apron passes, and consists in causing the said rollers to bite upon strips of leather, india-rubber, or other flexible material, so as to prevent them from acting upon the said apron direct. Another part consists in drying cotton, by causing a current of air, heated, or at the ordinary temperature, to be driven through the material by the exhausting or blowing action of a fan or fans.

1717. R. A. Smith.—*Improvements in purifying gas.* Dated July 6, 1861.

The patentee claims the purifying of gas from sulphur and its compounds, except sulphurretted hydrogen, by treating it with alkaline solutions of certain metals, in the manner described.

Correspondence.

ACTUAL AND NOMINAL HORSE POWER;
OR,
FIGURES OF ARITHMETIC *versus* FIGURES OF SPEECH

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—In the preceding number of this journal there is an article of about three and a half pages, headed "A Standard Horse Power for Steam Engines," in which article the writer states that it is customary to value engines by the conventional unit of horse power. That in Britain the manufacturers have approximated to a common standard, but in Canada and the States nominal horse power, as a commercial unit of capacity, or power of performance, is an exceedingly vague expression. He also says that scarcely two manufacturers will give the same dimensions; that scarcely an individual manufacturer's own practice is uniform, and that it is a desideratum to have a common standard which would enable buyer and seller to deal with greater confidence and certainty, and is therefore a legitimate subject for legislation.

The article being long, even to prove the writer's case, it will be unnecessary to refer minutely to every portion of it, but since it is only to enable buyer and seller to deal with greater confidence, we fancy it is no difficult matter to show that they can deal with equal, if not greater, confidence under the present standard than they would do with the standard he alludes to, by buying by the real, "the actual" or effective horse power instead of the "nominal" one which he recommends.

In the case he refers to, of giving evidence regarding the power of a steam machine, where there were a dozen of witnesses examined, we venture to say that nine of those witnesses were in favor of the present standard, while only himself and another were for the nominal horse power. The nominal horse power advocates lost the case. The writer of that article says no two of these witnesses held the same opinion, farther than that a horse power should indicate the ability to elevate 33,000 lbs. one foot high, in one minute. Now, their agreeing upon this point is all that is necessary, as it is the actual horse power—in reality what a horse can do. It was as much to avoid the difficulty arising from this not having been so universally agreed upon in Britain that the nominal horse power found favor, there being at that time a wide discrepancy of what a horse could do,

Smeaton allowing 22,916,
Desagliurs . . 27,500,
Watt . . . . 33,000 lbs., raised one foot high, in one minute, and because this last was more generally received in Britain than the others it came to be exclusively adopted in this country, and its being so adopted renders itquite unnecessary to bring in any other standard. Any difficulty that may have arisen as to the power of steam engines, between the manufacturers and the buyers, has been instigated by the advocates of nominal horse power, which does not, and we hope never will obtain, in Canada, as a standard; and for this reason, that it is more likely to confuse and mislead the uninitiated than the present standard of "actual" or effective horse power.

He says that a standard horse power is as necessary as a standard bushel or a standard yard. So it is. And 33,000 lbs., raised one foot high, in one minute, is this standard, and better than any number of square or circular inches of piston surface, which he recommends. If pressure and speed were constant quantities, then we could have no objection to that mode of measurement which he recommends, but as these are not constant quantities, to adopt his mode of measurement would be adopting a false measure of power—"a fiction"—a mere figure of speech.

He says the great difference between the nominal and actual horse power, culminated in the Great Eastern, whose engines were nominally 2,600 horse power, but which worked up to 8,300 horse power. If this proves anything, it does prove that 2,600 was a false measurement of the power of the engines of the Great Eastern.

The article under review contains about forty paragraphs, twenty-eight of which are devoted to the steam engine, and the remainder to the boilers for steam engines. In paragraph No. 6 it is stated that actual horse power is liable to many disturbing causes, some of which vary with every change in the dimensions of the machinery, and its final determination can never be arrived at with exactness until the engine is at work and a diagram indicator applied to the determined point at which the force is to be delivered. In reference to this statement we would simply remark that the actual horse power, so far as relates to buying and selling dimensions, is not liable to disturbing causes. The rule holds good in every case, and is always the same. The dimensions, of course, "vary with the pressure and the speed," but the rule does not vary, and by this rule the buying and selling dimensions are so easily computed that the veriest novice in mechanics can generally perform it.

The diagram indicator is quite unnecessary for determining the actual—the buying and selling horse power of an engine. It is desirable, however, to test by a diagram indicator every steam engine, from time to time, in order to find out its efficiency, "if in good working order," and when not in good working order or condition. The diagram indicator will point out where and what the defect or derangement is, so that it can be at once

rectified. The application of the indicator will discover some engines working above, and some working below the estimated power. Defects or excellences will cause this variation, but such defects or excellences do not, in consequence of this variation, invalidate the standard of measurement of actual horse power. This must be apparent to every one at all conversant with the subject.

In contracting for a steam engine it is understood that it will be free from any such defects in construction. It is necessary, however, and proper, that the buyer and seller agree, in the first place, as to the pressure to be used in the boiler, and the speed to be given to the piston, these being given the power is easily found from the following simple formula:

Let P = the pressure in lbs. per square inch on boiler,
a = the area of piston in square inches,
v = velocity in feet of piston per minute,

then $\dfrac{(P \times a \times v \times 2 \div 3)}{33000}$ = actual horse power.

One third of the gross power being deducted for condensation, friction and back pressure. Or, as some prefer the following formula, which gives the same result, take $\frac{2}{3}$ of the gross pressure on the boiler; call this the effective pressure; then:

Let EP = effective pressure—or $\frac{2}{3}$ gross pressure,
a = area of piston in square inches,
v = velocity of piston in feet per minute.

$\dfrac{EP \times a \times v}{33000}$ = the actual horse power.

It will be seen from the above that there is no necessity for any other standard as a commercial unit, the size of the engine in all cases being determined from the following given quantities:

The number of horse power required to perform the work assigned to it by the buyer.

The pressure to be used per square inch on the boiler.

The velocity to be given to the piston, in feet, per minute.

Let the phrase "nominal horse power" be excluded, as it has hitherto been from the vocabulary of the workshop, and there will be fewer cases of litigation in such matters in future, though not to the pecuniary advantage of the "nominal horse power" advocates, who fatten on such cases, and with whom they generally originate.

In engines with a condenser take the boiler pressure, to which add $12\frac{1}{2}$ lbs. per square inch; call $\frac{2}{3}$ of this the effective pressure, $12\frac{1}{2}$ lbs. being gained from the condenser.

The size of the condensing engine will be determined from the following elements:

The number of horse power required to perform the work assigned to it.

The pressure to be used on the boiler + $12\frac{1}{2}$ lbs. $\times\ 2 \div 3$ for effective pressure. — and —

The velocity of piston, in feet, per minute.

The writer of said article, so frequently referred to in seeking to establish a standard horse power in this country, might have chosen a much nearer approximation to the actual horse power than the British nominal one, seeing that by his own statement it is fully three times less than the actual horse power when the power of the engines of the Great Eastern were tested by the diagram indicator. From this example it would not be far from the truth to use the following formula:

$NH \times 3{\cdot}2$ = the actual horse power.

NH being the nominal horse power, as per the Great Eastern.

The writer confesses that in the early history of the steam engine the nominal horse power was intended to, and did approximately represent the actual horse power. Now, however, various rules are adopted by the manufacturers in different districts in Great Britain, where they have the "Manchester rule," the "Leeds rule," the "Glasgow rule," and the "Boulton & Watt rule." These rules again vary for condensing as well as non-condensing engines, and in giving an example of the Boulton & Watt rule he says they "assumed" the piston velocity to be 128 feet per minute—multiplied by the cube root of the stroke in feet; the mean effective pressure is "assumed" to be 7 lbs. per square inch (always something assumed), then the nominal horse power will be:

$\dfrac{\sqrt[3]{\text{stroke in feet}} \times \text{diam}^2 \text{ in inches}}{47}$ nearly.

This formula is very obscure, and does not seem to be constructed from the assumed conditions, as neither the velocity of the piston nor the main effective pressure is discoverable in the formula. Yet, he adds, in the South of England this formula is much used, substituting as the divisor 60 for 47, a difference, we would remark, sufficiently large to set aside this formula. And further, he says the Admiralty formula is somewhat similar, excepting that a different speed for the piston is adopted, according to the stroke of the engine. Thus, when the stroke is 3 feet, the speed is taken at 180, and, when the stroke is $5\frac{1}{2}$ feet, the speed is "assumed" to be 216 feet per minute. The effective pressure is always taken at 7 lbs on the inch, and the formula thus expressed:

$HP = \dfrac{\text{area of cylinder in inches} \times 7 \times \text{speed of piston in feet per minute}}{33000}$

This formula is very different to the preceding one, and when using an effective pressure of 7 lbs per inch, it gives the actual horse power of the engine. Next follows the Manchester rule, with 23 square inches of piston surface; the Leeds rule, with 30 circular inches for condensing engines; and for non-condensing engines. The Manchester rule is said to be 10 square inches, and Leeds 16 circular inches of piston surface. The Glasgow rule is said to give the same number of circular inches to that of Manchester's square inches.

It must be very clear to any person conversant with steam engines that to adopt either of these rules, or a medium between them, in Canada, would be to give away something certain for something uncertain—a reality for a fiction—something clearly understood for something indefinite. And from the great uncertainty of getting a more explicit knowledge of the size and power of an engine from any of these rules, than by our present standard of computation, we may safely leave them as so many crotchets of the time when pressure and speed were more uniform than they are now, in being almost constant quantities, when the one was limited to 7 lbs on the inch, and the other to 220 feet per minute.

The writer says that in estimating indicated

Boiler press — = 10·000
·0069
·0160
2·0000
·0069
1·8702
3·9000
6·1000
2/3 rds

Tredgold
N.B. The allowance of 1/3 off full pressure for eff: pressure is made up as follows. The force necessary for production of motion of the steam in cylinder ·0069 — cooling in cyl: and pipes ·0160 — Friction of piston & waste ·2000 — force req^d to expel the steam [illegible]

horse power, neither the power expended in working the air-pumps of condensing engines, the friction of the machinery, nor the force expended in working the valves, has usually been considered, the power in the cylinder being alone expressed by the ordinary formula.

Indicated horse power thus:

$$\frac{\text{Mean eff. pres.} \times \text{diam.}^2 \times \cdot 7854 \times \text{stroke} \times 2 \times \text{no. rev. per min.}}{33000}$$

Now, this is practically correct, and proves the preceding statement to be incorrect. Since all these items then referred to, are included in the reduction of gross pressure, per inch, on boiler, to Effective pressure, which is two-thirds of the former, one-third being deducted expressly to cover these items of resistance. The above formula is the same as that we have already given, only not so concise, which is:

$$EP = \text{effective pressure,}$$

$$\frac{EP \times a \times v}{33000} = \text{the actual HP.}$$

It was only in the early days of the steam engine that there was any dispute as to its power, as they could not agree as to the average strength of a horse, one giving 22,916, another 27,500, another 33,000 lbs, raised one foot high, in one minute. There was then some show of reason in the attempt to measure by surface of piston. This, however, is quite unnecessary here, since we all agree to the standard of 33,000 lbs. as the actual horse power. It will be observed that the nominal horse power is computed from an "assumed" speed, and an "assumed" pressure. Now, in computing actual horse power, nothing is assumed, the power being computed from the actual conditions laid down. For instance: A new steam engine is required of a certain number of horses power, the boiler not to be pressed above 50 lbs on the square inch, and the piston not to have a velocity beyond 300 feet per minute. These conditions determine the size of the engine. Take another case: A steam engine is required of the same power as the above, but the pressure on the boiler is only to be 30 lbs on the inch, and the piston velocity 250 feet per minute. The conditions, in this instance, will determine that this engine would require to be about twice the size of the former, consequently its cost would be considerably more than that of the former, yet of the same power. A great revolution in the construction of steam engines has taken place since the time when these rules of piston measurement were adopted, "and only partially adopted." The whole field of working steam expansively with increased pressure and speed, and which, with other improvements, the cost for fuel has been reduced in well made engines to a third of what it was at that time, that is, a bushel of coal, with our present well made engines, will raise a weight 3 times heavier, a given height, in a given time, than with the engines of that period—the period of the nominal horse power.

The "mechanical effect" of steam is now better understood and acted upon than at that period. This, however, and the subject of steam boilers, must be deferred until a more appropriate time.

Z.

BRITISH PUBLICATIONS FOR JANUARY.

Adderley (Rt. Hon. C. B.) On the present Relations of England with the Colonies	0	2	6	*Parker & Son.*
Ballhorn (F.) Grammatography, a Manuel of Reference to the Alphabets of A. & M. Languages	0	7	6	*Trübner.*
Banerjea (Rev. K. M.) Dialogues on the Hindu Philosophy, 8vo	0	18	0	*Williams & N.*
Beadle's American Biographies, Tecumseh, the Shawnee Chief, fcap. 8vo	0	0	6	*Beadle.*
Beufort (Emily A.) Egyptian Sepulchres and Syrian Shrines, 2 v. 2nd edit., post 8vo	1	5	0	*Longman.*
Beale (D.) Student's Text-Book of English and General History, new e. c. 8vo. 2s.; c.	0	2	6	*Bell & Daldy.*
Bland (William) On the Principles of Construction in Arches, Piers, &c., 12mo	0	1	6	*Weale.*
Burke (Sir Bernard) Peerage and Baronetage of the British Empire, 24th e., im. 8vo	1	18	0	*Harrison.*
Cassel's Hand-Book Guide to Railway Stations, fcap. 8vo	0	1	0	*Cassell.*
Chambers's Journal of Popular Literature, Science, &c., vol. 16, sup-roy. 8vo	0	4	6	*Chambers.*
Chronicles and Memorials of Great Britain. Johannes de Oxenedes, roy. 8vo	0	8	6	*Longman.*
Clever Girls of Our Time, and how they became Famous Women, fcap. 8vo	0	5	0	*Darton.*
Coffee Planting in Ceylon. By Aliquis	0	2	5	*Taylor & F.*
Creasy (Sir Edward) Rise and Progress of the English Constitution, 6th e. rev., p. 8vo	0	7	6	*Bentley.*
Entomologist's Annual (The) for 1862, 18mo	0	2	6	*Van Voorst.*
Frith (Francis) Stereoscopic Photographs of Views in Egypt, Nubia, &c., cr. 4to	3	3	0	*Smith & Elder.*
Gurney (J. H.) Chapters from French History; St. Louis; Joan of Arc; &c., fcap. 8vo	0	6	6	*Longman.*
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Miller (Wm. Allen) Elements of Chemistry, 2nd edit, with Additions, Part 3, 8vo.	1	0	0	*Parker & Son.*
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Universal History, from the Creation to the Accession of the Queen, n. e. 7 v. fp. 8vo	2	2	0	*Bagster.*
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Wauchope (Admiral) Proofs of the Cause and Date of the Boulder-Drift............	0	1	0	*Black.*
Weale's Rudy. Series, Vol. 111. Bland (W) Prin's of Const'n in Arches, &c., 12mo	0	1	6	*Weale.*

Reviews.

Chemistry, Theoretical, Practical, and Analytical, as applied and relating to the Arts and Manufactures, by Dr. Sheridan Muspratt, F.R.S.E. *William Mackenzie, London: Roy. 8vo., 2 vol.*

The name of Dr. Muspratt has so long been before the public as one of the distinguished practical chemists of modern times, that any work to which his name is attached, will be received with favour and confidence by the public. These splendid volumes are got up in a style far superior to that in which scientific works are usually published. Not only are all the more intricate processes of Practical and Applied Chemistry illustrated by excellent wood engravings, but we have admirable likenesses on steel of the most eminent chemists of Europe and America. Life like portraits of Playfair Faraday, Chaptal, Fownes, Gregory, Priestly' Wohler, Bunsen, Chevreul, Leibig, Morfit, Hoffman and a host of others.

All the new processes as applied to chemistry are given at considerable length and with very complete diagrams. The typographical execution of the work is admirable, and although the price is high yet there are few who are largely engaged in the manufacturing operations in which chemical principles are involved, who will not be tempted to find a place in their library for this handsome addition tion to works of reference in the applied Sciences.

Appleton's Dictionary of Machines, Mechanics, Engine-work and Engineering, illustrated with Four Hundred engravings in wood, in two volumes, Roy. 8vo.: New York, Appleton & Co.

To those who are in possession of the last edition of Ure's Dictionary of Arts, Manufactures, and Mines, edited by Robert Hunt, Appleton's Dictionary will appear to contain almost a reprint of many articles in that excellent work, but with numerous essays on different subjects, not treated of by the learned editor of Ure's standard work. The handsome volumes under review contain very many illustrations and descriptions of machinery which will render them especially attractive to a certain class of readers, but in the article on gas, and those departments of industry involving chemical processes the reader will find all the details in Muspratt's Chemistry, or in Ure's Dictionary. But it would not be doing justice to Appleton's dictionary if we were not to notice many very excellent descriptions of American progress in mechanism and engineering. It is especially in the department of Mechanical Science that these volumes are valuable, and in the descriptions given of the details of great workshops either of a private or public character in the United States, the practical man will find much information, which in these days of progress may be considered as indispensable.

Selected Articles.

THE NEW IRON-PLATED WAR STEAMERS FOR THE BRITISH NAVY.*

The first of them, the *Achilles*, which has recently been begun in Chatham Dockyard, so nearly resembles the *Warrior* and *Black Prince* that a very few words will suffice for her. The chief difference between her and those vessels lies, I believe, in the fact that her beam is slightly broader, and her floor somewhat flatter, than her predecessors; whereby her tonnage is increased from 6,039 to 6,089 tons, and her displacement from 8,625 to 9,030 tons. All her other dimensions, and all her essential features of construction, are exactly like those of the *Warrior*—from which it may be inferred that the method of plating the central part only of the ship, which was introduced by your distinguished Vice-President, Mr. Scott Russell, is still viewed with favour by the Admiralty designers. Mr. Scott Russell did not patent his invention, I believe; perhaps he will kindly tell us whether he has found his rejection of the Patent Law to pay him well in this instance.

In the class of ships which come next, however, the Admiralty have consented to forego the plan of plating amidships only, and purpose plating the ship from end to end with thick iron. But in order to do this it has been necessary to resort to

* Abbreviated from a paper by E. J. Reed, Esq., member and Secretary of the Institute of Naval Architects.

larger dimensions than the *Warrior's;* and hence these six new ships, three of which have just been contracted for, are to be 20 feet longer than her, 15 inches broader, af 582 tons additional burden, and 1,245 tons additional displacement. As the displacement is the true measure of the ship's actual size below the water, or of her weight, it is evident that the new ships are to be considerably more than 1,000 tons larger than the *Warrior's* class. As their engines are to be only of the same power, their speed will probably be less. This diminished speed is one of the penalties which have to be paid for protecting the extremities of the ship with thick plates. Another will probably be a great tendency to plunge and chop in a sea-way. The construction of such vessels is a series of compromises, and no one can fairly blame the Admiralty for building vessels on various plans, so that their relative merits may be practically tested.

The cost of this new class of ships will exceed that of the *Warrior* class by many thousands of pounds, owing to the increased size. But it will certainly be a noble specimen of a war-ship. A vessel built throughout of iron, 400 feet long and nearly 60 broad, invulnerable from end to end to all shell and to nearly all shot, armed with an abundance of the most powerful ordnance, with ports 9 feet 6 inches above the water, and steaming at a speed of say 13 knots per hour, will indeed be a formidable engine of war. And, if the present intentions of the Admiralty are carried out, we shall add six such vessels to our Navy during the next year or two. We must be prepared, however, to dispense with all beautifying devices in these ships. Their stems are to be upright, or very nearly so, and without the forward-reaching "knee of the head" which adds so much to the beauty of our present vessels. Their sterns will also be upright, and left as devoid of adornment as the bows. It should also be stated, as a characteristic feature of these six new ships, that their thick plating will not extend quite to the bow at the upper part, but will stop at its junction with a transverse plated bulkhead some little distance from the stem, and this bulkhead will rise to a sufficient height to protect the spar deck from being raked by shot.

It has not yet been decided whether these new iron ships are to have their plating backed up with teak timber, as in the previous ships; or whether plating 6½ inches in thickness, without a wood backing, is to be applied to them. The determination of this point is to be dependent, I believe, upon the results of the forthcoming experiments with the large targets to which I have previously adverted, and partly upon the recommendations of the Iron Plate Committee, to which our President belongs, and which is presided over by the distinguished officer now present, Captain Sir John Dalrymple Hay, R. N. All that has been decided is, that whether the armour be of iron alone or of iron and wood combined, its weight is to be equivalent to that of iron 6½ inches thick. The designs of the ship have been prepared subject to this arrangement, and provision has been made in the contracts for the adoption of whichever form of armour may be deemed best when the time comes for applying it.

All the iron-cased which I have thus far described are built, or to be built, of iron throughout, except in so far as the timber backing of the plates, the planking of the decks, and certain internal fittings may be concerned. I now come to notice a very different class of vessel, in which the hull is to be formed mainly of timber, the armour plating being brought upon the ordinary outside planking. The *Royal Alfred*, *Royal Oak*, *Caledonia*, *Ocean*, and *Triumph* are to be of this class. Their dimensions are to be—length 273 feet, breadth 58 feet 5 inches, depth in hold 19 feet 10 inches, mean draught of water 25 feet 9 inches, and height of port 7 feet. They are to be of 4,045 tons burden and to have a displacement of 6,839 tons. They are to be fitted with engines of 1,000 horse-power. They are being framed with timbers originally designed for wooden line-of-battle ships, but are to be 18 feet longer than those ships were to be. They will form a class of vessels intermediate between the *Hector* and the *Warrior* classes, but, unlike both of them, will be plated with armour from end to end. They will be without knees of the head, and with upright sterns; and will, therefore, look very nearly as ugly as *La Gloire*, although in other respects much superior vessels, being 21 feet 6 inches longer, 3 feet 5 inches broader, and of less draught of water. They will also be quite equal to her in speed.

It will occur to some now present, that in adopting this class of ship, we have, after three years' delay, approximated somewhat to the *Gloire* model at last. And undoubtedly we have done so in the present emergency, in order to compete with the movements which France is now making. At the same time we have not gone to work quite so clumsily as our neighbours. Instead of retaining the old line-of-battle-ship proportions, we have gone somewhat beyond them; and have lifted all the decks, in order to raise our guns higher above the water. We have consequently secured a height of port or battery nearly 18 inches greater than *La Gloire's*—an advantage which will prove valuable under all ordinary circumstances, and incalculably beneficial in rough weather.

Let me now consider briefly the pecuniary phase of this iron-cased ship question. We may fairly assume that the average cost of such vessels will not be less than £50 per ton, and that their engines will cost at least £60 per horse-power. Supposing these figures to be correct, then the hulls of the eighteen ships which we have been considering will cost us £4,681,600, and their engines £1,143,000—together nearly *six millions* pounds sterling. When masted, rigged, armed, and fully equipped for sea, they will of course represent a much larger sum—probably nearly *eight millions.* These estimates will afford some faint conception of the nature of that "reconstruction" of the Navy upon which we may now be said to have fairly entered, in so far as the ships themselves are considered.

Copper.

At Ontonagon, Lake Superior, the National mines yielded 107 tuns, 1078 lbs, of copper in the month of December last. Of this amount there was 123,487 lbs. of it in masses. A French company is going to erect copper smelting works in the Ontonagon district next spring.

RECENT PROGRESS OF THE MAGNETIC TELEGRAPH.

I.—The Pacific Telegraph. II.—The California Telegraph. III.—The Malta and Alexandria Telegraph. IV.—Telegraph in Europe. V.—Telegraph Extension on the Pacific.

The Pacific Telegraph.

On Thanksgiving day, the 28th ult., says the Rochester *Union*, a large party of the workmen engaged in constructing the Pacific telegraph from the western borders to Salt Lake City, under the direction of Mr. Creighton, arrived at Omaha on their return. The line had been constructed previous to July, 1861, as far west as Julesburgh, which is on the Platt River, 300 miles east of Denver. From that point to Fort Bridger, about 700 miles, the line was constructed by the party of which Mr. Starr was one. Mr. Creighton had from 75 to 80 men employed, and they were divided in three trains. The men of one train dug the holes, those of another cut down the poles and set them, and a third put up the wire. In the three trains there were about 75 waggons and 700 cattle, including a few milch cows, to furnish milk for the men. The waggons contained from 35 to 45 hundred pounds each, consisting of wire, insultators, tools, camp equipage and provisions. The trains were said to be the best that ever started over the plains —the cattle being excellent, the waggons good, and all that pertained to the comfort of the men was in keeping with the rest. Good tents were provided, also cooking stoves, and all the necessary utensils for providing meals, and—what was quite in keeping with these—the best food that could be conveyed over the plains and mountains.

The first pole was set on the 4th of July, at Julesburgh, and the last on this section at Fort Bridger, about one hundred miles this side of Salt Lake City, on the 15th of October. The diggers' went ahead and got along at the rate of about twelve miles per day, digging about twenty-four holes for each mile. The train which put up the poles only made about ten miles per day, and was one hundred and fifty miles behind the diggers when the latter reached the end of the route. On the plains the digging was easy, and the work went rapidly on; in the mountains it was slow, owing to the rocky soil.

The poles were selected, cut, stripped of bark by the men, and were then drawn out by the cattle and distributed along the line. In some localities excellent timber was found in great abundance, hard pine being most plenty, though some cedar was obtained. Dead or dry pines were often found in large quantities, some of which would make three poles each of suitable size. In some localities the poles had to be cut in the mountains, and hauled over one hundred miles. Each pole is twenty feet in length, and is buried four feet in the ground. Through the Rocky Mountain Pass, where the line runs, there are points where the snow is known to cover the ground to the depth of eleven feet.

The line is well put up, and is substantial as such can be. It has a single wire, not exposed to damage from the falling of trees, as care was taken to avoid every thing of that kind.

The route adopted was mainly along the road, across the plains and through the mountains. To shorten distances, where the road ran in a serpentine form, the telegraph takes a direct line, following the general course of the road. The track pursued by the western trains over the plain is very crooked, often made so by the cattle dying in the path. When an animal falls, its carcass is seldom removed from the track, except as the wolves carry it away by piece-meal; and trains which follow turn out to avoid it, thus making a crooked path, for the bones of thousand of animals lie bleaching along the great paths that lead from the Missouri to the Pacific.

The constructors of this Telegraph line met with no hostile Indians, though they saw many of the natives along the way, and sometimes suffered by their thieving depredations. The Indian Agent at Deer Creek, sixty-five miles above Fort Laramie, told Mr. Starr that one of the Sioux chiefs conversed with him about the telegraph project before the poles were set, and said that he understood that poles were to be set sixteen feet high, and then strung with wires closely from top to bottom. As this would make a wire fence, all the buffaloes and other game would be kept from coming to the south. He looked upon the project with disfavor; but when he understood that there was to be but one wire, and that sixteen feet above the ground, he was quite relieved of his fears, and appeared to be satisfied. Speaking of the manner in which the natives regard the telegraph, Mr. Starr says the antelopes were timid and distrustful. Herds of them crossing the plains would stop when they came to the telegraph, and cautiously examine the poles before venturing to pass between them.

The stations of the telegraph operators are chiefly at the stations of the mail company, from fifty to one hundred miles apart. There are usually two or three persons at each station, taking care of the mules of the stage company, and these are all the society the operator has. The work for repairing the same must, for the present at least be performed by the operators going out when they find communication with the next station interrupted. The duty of an operator and repairer is anything but a pastime, and to perform it well requires hardy, courageous men, who are not afraid to be alone, and to contend with snow storms and whatever else they may meet in that vast wild region over which they must sometimes travel. The right men will, in time, be found in the right places; and of the successful working of the telegraph to the Pacific, none are more confident than the men who constructed it, and who, therefore, best know what obstacles are in the way.

California Telegraph Tariff.

The rates as fixed from St. Louis are according to the following table:—

First 10 words,	$4 25
Next 90 words, (each,)	36
Next 400 words, (each,)	24
Next 500 words, (each,)	18
After 1,000 words, (each,)	12

These rates for the lowest amount of matter telegraphed strictly conform to the act of Congress, which limited the maximum to $4 25 for the first ten words, and thirty-six cents for each additional. The rates from New York to San Francisco are

$5 95 for the first ten words, and forty-eight cents for each subsequent word, the difference being the present charges between New York and St. Louis. As yet, through rates are exacted upon all despatches to Salt Lake City, Carson City, and other intermediate stations on the route, no way rates having so far been determined on. This irregularity will, however ,it is said, be of only short duration, as at a meeting of the company, soon to be held in New York, a way schedule will be agreed upon. The impression that the present rates are too high, either for the accommodation of the public or the interests of the company, is one which time may confirm. Such is the opinion of some of the corporators.

The President's message of December, 1861, was telegraphed from New York to San Francisco in thirty-six hours. The cost of this was about one hundred and fifty-six dollars. The difference in time between these two places is about three hours. The ordinary time occupied in the transmission of a short message is about three hours, so that a short message, leaving New York at 9 A. M., will reach San Francisco at 9 A.M., their time.

THE GROWTH OF CORAL REEFS.

A LECTURE BY PROFESSOR AGASSIZ.*

A question which excited the greatest interest a few years since, was in relation to the time at which animals first made their appearance on earth. It was formerly supposed that we knew exactly how many years had elapsed since all animals were created, but on examination it is found that the chronology of Genesis relates only to man, and we now know that the lower orders of animals existed long before man was created. I will give you an account this evening of the animals that build the coral reefs, and will present some facts indicating the periods during which they have been at work.

Coral is not the shell of an animal, but it forms the hard part of his body, just as much as our bones are parts of our bodies. If any of you have seen the jelly-like animal that floats about the docks of our harbors—the Sea Anemone—you can form a very good idea of the coral animal.

The carbonate of lime which forms the durable part of the animal—the part with which we are all familiar—is drawn in by the animal with its food, and is secreted by its organs and deposited on the outer wall of its body and on the radiating divisions thickening them. The soft parts of the polyp are capable of such variations in volume that they may be expanded or contracted so as to be contained in a cavity in the upper portion of the cylinder.

Coral reefs are built in this form. A horizontal line represents the surface of the water, and a lower line the bottom of the sea sloping downward from the shore. The reef is nearly vertical on the sea side, and considerably inclined on the side next the land. They are always commenced in water from 10 to 12 fathoms in depth, never more than 72 feet, never less than 60.

This statement may seem to conflict with that of Capt. Cook, that he brought up corals in the Pacific Ocean from a depth of 2,000 feet. But, though I have no doubt of the truth of Capt. Cook's statement, and though I know that mine is correct, there is no conflict between them. It is ascertained that the bottom of the Pacific Ocean is subsiding, and we know the direction of the subsidence. The corals that Capt. Cook recovered from so great a depth were the limestone remains of animals that had long been dead. They grew at the usual proximity to the surface. and were carried down with the settling of the ocean bed.

There are several species of corals, and each lives at a certain depth beneath the surface; being unable to exist either above or below the zone for which it is adapted. This is not strange when we consider the very soft character of its body, and the rapidity with which the pressure of water increases with the depth. At the surface there is a pressure of one atmosphere, at a depth of 32 feet, a pressure of two atmospheres, and at the depth of 64 feet a pressure of three atmospheres, and this is as great a pressure as any of these animals can bear.

Each coral reef is built by four species of polyps; the bottom being constructed by the species which lives at the greatest depth, and the several parts above by species inhabiting corresponding strata of water. The reef builder lays the foundation at the base of the outer wall; and the growth is more rapid there than it is in the parts nearer the land. For this polyp is adapted to clean sea water, and will not live in the foul water inside the reef. The reef, therefore, soon assumes a form similar to that which it has in its finished state. When the species of polyp that lives in water of 10 or 12 fathoms in in depth has carried the structure up through the zone which it inhabits, his labors cease, and the work is continued by a second species. As the species does not require water so pure as the first he extends his growth towards the shore. Having grown upward through his stratum of water, his growth ceases, and a third and fourth species complete the reef.

It was at one time a mystery to us that one species could thus apparently grow out of another. But in examining the mode of reproduction of these polyps, I discovered facts which explained the mystery. Though the mature animal is attached immovably to the rock, when first hatched he swims through the water, and is confined to the same stratum of depth as in the matured state. When swiming about in this undeveloped state, if he encounters the upper surface of a coral reef which has grown up to his stratum of water he attaches himself to it and then begins to grow; thus continuing the structure.

These polyps multiply and grow by a process of budding. A protuberance appears upon one side of the body, which finally develops into a perfect animal; but is not separated from the parent, making a compound animal of numerous individuals united together. However strange this process may seem to us in the animal kingdom we are familiar with it in the vegetable. Each bud of a tree is a complete individual in itself, but they all unite to form a common plant.

The peninsula of Florida has been formed by these little animals, and they are still extending it southward toward the island of Cuba. In connection with the operation of the Coast Survey I visited the southern part of Florida and I made some ef-

* *Scientific American.*

forts to ascertain the rate of their growth. The foundations of Fort Jefferson, on Tortugas Island, and of Fort Taylor, at Key West, showed that the reefs had risen one inch in Fourteen years. This would give in round numbers, after allowing for inaccuracies, say one foot in a century. This is doubtless more rapid than the actual growth, as the mass near the bottom is crushed together and compressed by the superincumbent weight, and it would probably take at least two centuries to grow one foot But calling it one foot in a century it would take a reef sixty centuries or six thousand years, to rise from a depth of sixty feet to the surface.

Let this indicate the outline of the southern end of Florida. Nearly parallel with the coast, diverging from it toward the west, is a row of small islands, called keys, and beyond these again a row of still smaller islands, which are called coral reefs. On examining the keys, too, they are found to be reefs of coral. Now, as the reef building polyps can live only in the clean sea water, and perish if brought into the muddy water inside the reefs, we come to the conclusion that the keys were built up before the outer reefs were commenced. And if we allow the same rate of growth for them, their foundations must have been laid at least 12,000 years ago.

Along the coast is a marshy tract of land called the Indian Hunting Grounds, and beyond this, still parallel with the coast, is a row of low elevations called hammocks, rising some ten or twelve feet above the surface of the swamp, the mountains of that district; and these, on examination, are found to be still older coral reefs, carrying back our chronology another 6,000 years. Beyond these there is still another row, making 24,000 years.

The distance from the outer reefs to those last named is fifteen miles. I am told by intelligent officers of the army who have explored the country to Lake Okeechobee, sixty miles inland, that it is all formed of series of coral reefs. In fact, the whole peninsula of Florida is a coral formation, and we are brought to the conclusion that hundreds of thousands of years have been consumed in its slow growth.

And yet this is to-day in the chronology of our globe. The polyps that have built up Florida belong to living species. In the divisions of geologists this is the present formation. When we examine rocks formed by extinct species, we are led to a knowledge of periods still more inconceivable, during which nature has been conducting her operations.

HARDWARE IN THE EXHIBITION OF 1862.

The *Ironmonger* says:—Exhibitors in the hardware centres are now manifesting considerable interest in the Exhibition of 1862, and great activity is being displayed in preparing specimens. It is said, on the authority of the Royal Commissioners, that the total demand for floor space is seven times the quantity of that available. That being the case, the awards of space of floor do not appear liable to dispute, and, admitting that the duties are arduous which the local committees have had to perform, their hands have been strengthened by a most judicious letter which has been issued by the Royal Commissioners, and which is full of information, alike to local committees and exhibitors. In that letter exhibitors are encouraged to endeavour to pile their goods, in the official words, by the "construction of screens or vertical cases, rising above the counters, or objects arranged on the floor. These screens, throughout the building, may be at least 12 feet high, and in some cases 25 feet, or even higher." Very few general hardwares, however, can be so treated, and the exhibiting of them prove of advantage to the exhibitor. For articles which will be suspended over head (not on walls) there is, practically, an unlimited space at the disposal of the Commissioners. Of this mode of exhibition, too, hardware manufacturers will, generally, be unable to avail themselves.

Steps are being taken in Wolverhampton which are likely to revive the great lock controversy of ten years ago. There is now in course of manufacture in that town a new patent keyless lock, having 244,140,125 combinations, to open all of which would take a man—supposing he could live so long—some 130 years! This extraordinary lock, which is based upon the permutation principle, is the invention of Viscount de Kersolon, of Paris, and by him communicated to Mr. Edward Loysel, of Cannon street, London, who is better known as the patentee of the coffee percolator. Although it is termed a keyless lock, it has as many keys as there are combinations, the back parts being the locks and the front parts the keys, which cannot be removed. Every change made in the concentric rings answers the same purpose as the keys, so that a lock which has seven permutations, or 5,040 combinations, has 5,040 keys, and so it is termed a keyless lock, with 5,040 or any number of keys. The specimen has six concentric cylinders, upon the projecting or outer edges of which are twenty-five of the twenty-six letters of the alphabet, and it is only when these letters are brought to a certain predetermined arrangement that the other parts of the lock can be worked as to admit of the bolt being drawn for the purpose of shutting or opening the article to which the lock is applied. It is absolutely necessary, as in the old letter padlock, to know the proper arrangement or combination of letters before the lock can be opened. In order to prevent the particular combination of letters from being discovered by feeling the parts, as is sometimes the case, the inner edges of the moveable concentric cylinders are toothed or serrated, so as to deceive any person who may attempt to tamper with the lock. In the event of the particular combination of letters not being discovered by the person desirous of opening the lock, the exhausting of all the variations which are in that case necessary to the success of the operation would entail an expenditure of the time we have mentioned, supposing the operator to make ten changes a minute, and to manipulate ten hours on every working day. It is intended to place these locks on some iron safes that are also being made in Wolverhampton for exhibition at the forthcoming "World's Fair." In one of the safes it is proposed to place the sum of £500, which is to fall to the lot of the person who may be fortunate enough to effect an opening into the safe. The production of the lock for the market is in the hands of Mr. Aubin, the inventor of the "Trophy lock of inge-

nuity," which was exhibited in the Hyde-park Palace, and subsequently purchased by Mr. Hobbs. Mr. Aubin, then a working locksmith, is now the proprietor of works in Wolverhampton, where he employs machinery invented by himself, and of equal delicacy with that displayed in the model which made his name celebrated. His ingenuity is being further displayed in the designing and constructing of machinery adapted to the manufacture just described. Mr. Aubin's practical experience also is being brought to bear in making such improvements upon the Count's lock as are required to increase the probability of its success in a financial aspect. The principle of the lock may be applied to every variety of this description of fastening, and when used upon a travelling-bag is a vast improvement upon locks that require keys to open them, and is at the same time a great ornament.

WESTERN AUSTRALIA.—GREGORY'S EXPEDITION.

It is seldom we have, on the departure of the foreign mails, events to report so interesting and important as those which have transpired since our last summary. The safe return of Mr. Gregory and his party from exploring that portion of Australia lying between Shark's and Roebuck Bays, after an expedition which has been not only successful in its results, but also carried out without a single mishap to any of the party, is a matter for congratulation to himself and all concerned in promoting it. The discovery of a very great extent of good country, of easy access, and well watered by large rivers and frequent smaller springs, is too unusual in Australia not to exite great attention in England, particularly as one of the main objects of the expedition was to ascertain whether the country was available for the culture of corn, which we maintain it has proved to be in an eminent degree. Mr. Gregory's journal has not yet been made public, but from the information given by him, we gather that from Nichol Bay, the starting point, the route was generally to the south-west and south-east, until within sight of the Valley of the Lyow, the country generally being fertile grassy plains, crossed by a range of Hills named Hamersley Range; two rivers were met with—the Fortescue, a stream two hundred yards wide, in longtitude 118 deg., 4 min. E., lat. 21 deg. 8 min. S., with steep and strong banks, and the Ashburton, in about 23 deg. S., trending towards Exmouth Gulf. On the return to the coast a more easterly direction was taken, when a third river named the Sherlock was met with and followed to the coast 20 miles west of Depuch Island, much of the country being of a grassy fertile description, which was also its character from thence southwards to Nicol Bay, where the party arrived on the 19th July. A fresh start was made on the 20th, crossing the Sherlock, and taking an E.S.E. course met with a river named the Yute, in 21 deg. 4 min. S., which was followed for two days through a grassy, well-watered but rocky country. An easterly course took them through a hilly country to a river named the Stelley, lat. 21 deg., 27 min. S. long. 119 deg. 23 min. E.; a course still to the E. was continued, and a river named the Shaw was met with in 119 deg., 44 min., E., 21 deg. 15 min. S., flowing north through a good country. The easterly course was continued, passing a river named the De Grey, in 120 deg., 30 min., E., and 21 deg., 18 min., S., and another named the Sakover, running to the north, with very superior country, and still further to the eastward the party was stopped by extensive plains of drift sand, evidently brought by some large river from the interior, and blown from its bed across the plain by strong S.E. winds.

Attempts were made for five days without success to get further eastward, when a return was made by the Oakover and De Grey, through a fine grassy country, extending from ten to twelve miles from the river's banks. The sea coast was made at Broadsea Inlet, where was found a fertile alluvial district. A south-west course was then taken to Nicol Bay. It will be seen that although Mr. Gregory was unable strictly to explore the whole extent of the country comprised in the route set forth by the Royal Geographical Society, an important district has been traversed which before long will undoubtedly become occupied for pastoral and also, probably, agricultural purposes. The country appears to be remarkably fertile, and well watered but wanting in timber, which was only to be met with on the banks of the river; the heat appears to be great, but not so as to distress the party. The rivers abounded with fish, and no alligators were seen in them. Many of the flowers met with are described as being of the most gorgeous colours; fruits of the fig and mango kind are said to be plentiful. Animals were scarce, but several new varieties of birds were found. At Nicol Bay the crew of the *Dolphin* found the large pearl shell of commerce plentiful, and also some very good pearls were obtained, as also four tons of the shells. The rivers discharge themselves into the sea by separating at some distance into several small creeks, and as the tide rises from 16 to twenty feet, it is therefore easily to be understood how it is they were not discovered by the naval surveying ships, which have been at times employed on the coast, The most easterly point reached was long. 121 deg., 40 min.—From the *Perth* (Western Australia) *Gazette.*

EXPLORATIONS IN AFRICA.

At a recent meeting of the Geographical Society, several papers were read relating to discoveries in Eastern and in Western Africa. A letter from Mr. Thornton, who had joined the expedition undertaken by Lord van Deccan, for the exploration of the equatorial region on the east coast, gave an account of the discovery, or rather of the confirmation of the discovery, of lofty mountains capped with snow, within 200 miles south of the equator. The existence of these mountains, when noticed by former travellers, had been doubted, for they were supposed to have been deceived as to their altitude. But it appears, from Mr. Thornton's description, that the height of the principal one had been ascertained by numerous measurements to be 20,000 feet. The summit, as seen from the south-east, presents the appearance of a dome, and about one third of it was covered with snow, which extended in the ravines farther down the mountain. Other mountains towards the west were seen, the height of which was estimated at about 18,000 feet. They

had conical summits, and from their general character, Mr. Thornton considered them to be volcanic. These mountains are supposed to be the southern extremity of the range extending from Abyssinia, and that the water courses descending their western flanks from the sources of the Nile. Colonel Sykes eulogised the enterprising conduct of Lord van Deccan, a Dutch nobleman, who, at his own cost, had undertaken several expeditions for the exploration of Africa, and to whose spirited enterprise and liberality the world is indebted for having had set at rest the question of the existence of snow-capped mountains in Africa within a short distance of the equator. Two communications recently received by the Colonial office were then read by Mr, Galton, giving accounts of the assent of the Ogun, in Western Africa, by Captains Burton and Bedingfield, and of an expedition up the river Volta, on the same coast, by Captain Dolben. The country on the banks of the Volta was described as being luxuriant in vegetation, and well adapted for the cultivation of cotton. Captain Hartwright gave an interesting description of a tribe of negroes who inhabit the district of Lagos. They are, he said, remarkably intelligent, and exhibit great aptitude for trade, being on that account called black Jews. They have shops and warehouses, and some of them have their correspondents in England who supply them with goods. The peculiar intelligence of this tribe is observable even when in a state of slavery; and in the Brazils there is a thriving community of them who, having purchased their freedom, occupy an important position among the people, for it is the practice in the Spanish and Portuguese colonies to admit free blacks to all the privileges enjoyed by other citizens. On being questioned as to the probability of obtaining a supply of cotton from the western coast of Africa, Captain Hartwright said that the country was well adapted for the growth of cotton, but until the wars among the tribes, which had been incited by slave-hunting, ceased, there would be no cotton cultivated, and he recommended an armed interference by this country to put an end to the wars among the natives.

THE LAWS OF COOLING.

A warm body, says the *Builder*, loses its heat by radiation from its surface, and by contact with cold surrounding substances. The laws of cooling have been long knowu, and are expressed in the formulæ of Newton and of Dulong and Petit. From their experiments, confirmed by subsequent researches of others, we learn that the heat lost by radiation varies with the nature of the exposed surface. Polished metal emits caloric much more slowly than wood or any rough material. We learn also that the heat lost by contact varies with the form and extent of the surface of the warm body, and with the excess of its temperature over that of the surrounding medium. A cube cools more rapidly than a globe of the same material, and of equal weight, because the surface of the former is larger in proportion to the mass than the surface of the latter. Red-hot iron becomes cold almost instantaneously when plunged into water; whereas, if left in the open air, it might retain its heat for hours, or even days. When we know the temperature of the surrounding medium, the form of the body, its weight, and calorific capacity, we can easily determine its rate of cooling and its temperature at every instant. In practice, it is seldom, if ever, necessary to take into account the conducting power of the body itself. Bad conductors, when placed in a medium colder than themselves, may be warmer at the centre than on the outside; but this difference of temperature is slight and unimportant. Gold has nearly ten times the conducting power of lead, and nearly three times the conducting power of iron and platinum; but all these metals are subject to the same laws of cooling. The difference in the rate of cooling upon the outside and in the interior of a mass of gold, and of a similar mass of wood or iron, is a matter of no practical moment. The conducting power of a body cannot be measured except in those cases where its heat passes out of itself into surrounding substances.

An inclosed space like a room, office, or house, is subject to the same laws of cooling as a warm body of similar form, or equal bulk, and of equal calorific capacity. A room filled with warm air, and without any openings for currents, would lose its heat slowly through the walls, roof, and floor; so slowly, indeed, that a perfectly air-tight building filled with warm air would retain its high temperature inside for many months, even if carried in the depth of winter to Iceland or any other part of the frigid zone. The cold of winter pierces very slowly through our walls and roofs. It rises still more slowly from the ground. The most of our building stones conduct heat as rapidly as cast iron. The addition of layers of other materials outside and inside, such as mortar, wood, paper, &c., diminishes this conducting power, and reduces it in most cases so far that it may be disregarded. Snow, also, is well known to be a medium peculiarly impervious to cold; a roof covered with a coat of snow, at 32 deg. is warmer inside than when it is exposed bare to the atmosphere at 32 deg. A very thin layer of mould protects vegetables from the frosts of winter, provided only the covering be impervious to the air. So, also, contrary to the ancient practice of raising thick partitions for securing warmth as well as safety, we find that the heat of the interior of a building is affected only in the slightest degree by the nature or thickness of the material which forms its exterior. In regard to our dwellings, where fresh, and, consequently, in winter, cold air is necessary to our existence, the whole subject of their warmth and healthfulness is reduced in practice to the regulation of the currents out and in, or their ventilation. In regard to icehouses and similar places for keeping in and shutting out the cold, the main point in practice is to prevent altogether the entrance and exit of air.

These simple general principles, well known, yet most important at this season of the year, deserve specially the attention of those engaged in the manufacture and preservation of ice.

ON THE GEOLOGICAL PHENOMENA OF THE SOLAR SYSTEM.

BY L. SŒMANN.*

We admit a similar geological (or chemical) constitution for the various bodies of the solar system, and from this conclude that the phenomena which have accompanied their formation and their successive transformations, must have been similar. Thus the planets and satellites whose density is near to that of our earth may be supposed to have passed through the different stages of liquid and solid incandescence, of the successive liquefaction of portions of their gaseous envelopes, and to have finally been the seat of an organic creation.

Of these planetary bodies the best known to us is the moon, and we shall now inquire to what extent our slight knowledge of it is in accordance with the observations made on our earth, and w th the present state of the sun as supposed by Mr. Leverrier. It is well known that astronomers, so soon as they became possessed of good telescopes, discovered mountains and plains (or seas) on the surface of the moon, and the immediate application of these names shews the great resemblance which was supposed to exist between the surfaces of the moon and the earth. It does not appear surprising that the form of the lunar mountains should be met with among only a small number of those on our planet, and physicists easily explain the greater elevation and the steep declivities of the former by the comparatively feeble action of the centripetal force at the moon's surface. But one of the gravest objections to the idea of a common origin of the moon and the earth is the apparent absence of water and air from the surface of our satellite, thus seriously embarrassing those geologists who attribute terrestrial volcanic phenomena to the intervention of these expansible elements.

If however we admit for the earth and the moon an identical and simultaneous point of departure we can understand that their cooling has taken place at a rate nearly proportioned to their volume. That of the moon being about two hundredths the volume of the earth, its temperature, if we admit an equal conductibility, will have decreased with a rapidity fifty times greater, so that the geological epochs of the moon will have been in the same proportion shorter than the corresponding epochs on the earth, up to the time when the solar heat began to be an appreciable element. The moon has then advanced much more rapidly than the earth in the series of phenomena through which both must pass, and we may therefore logically suppose that our globe will one day offer the same general characters as are now presented by the moon.

We believe then that the waters which cover the surface of the earth and the air which surrounds it will one day disappear, as a necessary consequence of the complete cooling of the interior of our planet. Rocks, with few exceptions, readily absorb moisture, and the more crystalline varieties are the most porous; we need not, however, consider the quantity of water which rocks may imbibe in this way, for the total amount of this element on the earth's surface is so small when compared with the whole mass of the globe, that the ordinary processes of chemical analysis would not detect its presence. If we take the mean depth of the ocean at 500 meters* (=1968 feet), its weight will be equal to one twenty-four-thousandth of the earth, which being reduced to decimals, would give for 100 parts,

Earth	99·9958
Water	·0043

In the Bulletin of the Geol. Society of France, (2d series, vol. x., p. 131,) Durocher has published a series of experiments made to determine the quantity of water in those minerals which enter into the structure of rocks, such as the feldspars, micas, hornblende and pyroxene, and which are regarded as anhydrous in composition. These minerals were reduced to coarse powder and exposed to moist air, the proportion of water being determined both before and after; it will be sufficient for our purpose to give the amount of water found after exposure. The orthoclase of Utoë absorbed in this way 0·41 for 100 parts, while the mean of seven other varieties of the same species was 1·28, and that of thirty specimens of various substances 1·27. We have already seen that if the whole of the ocean were to be equally distributed throughout the earth this would contain only 0·0042, or 100 times less than the least hygrometric of the feldspars. It is probable that the water of the ocean thus absorbed would enter into chemical combination; at all events it would occupy a space much less than the pores produced by the shrinking of the rocks.

If, now, we attempt a similar calculation for the atmosphere, we find that in supposing a height of eight kilometers, the total volume of the air which surrounds our globe, brought to the density which it has at the surface, would be about four millions of cubic myriameters, the volume of the earth being equal to 1083 millions, or 270 times that of the air, so that a contraction of the primitive volume producing a vacuum of four thousandths ($\frac{1}{250}$) would be more than sufficient to absorb the whole of the atmosphere. (In calculating the volume of the atmosphere we have multiplied the surface of the globe in square myriameters, by 0·8, which gives a sufficiently accurate result, the more so that the density of the air in the interior of the earth will be everywhere greater than at the surface.)

From the preceding considerations, the sucessive absorption of the air and water by the solid portions of the globe becomes in the highest degree probable, and we may conclude that our earth will one day present that same total absence of ocean and atmosphere which we now remark in the moon. It is evident that this progress of the waters towards the earth's centre must have long been in operation, and it becomes interesting to consider the effect which this must have had upon the level of the ocean. Let us suppose that the rocks near to the surface of the earth contain one hundredth of water, a proportion which from the

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* Translated for the *American Journal of Science*, by Dr. Sterry Hunt. (Abreviated.)

* This depth is deduced from the comparison of the relative areas of land and water which are taken as 1:3, the elevation and depression of the surface being assumed as proportional to the square roots of their surfaces. (Saigey, *Physique du Globe*, 232.) The depth of the Pacific Ocean, as deduced by Bache from the earthquake wave of December, 1854, was about 13,000 feet.—(Note by the Editors of *Sillimans' Journal*.

above calculation will not be regarded as excessive, and that the water moreover does not exist in this proportion at a depth beyond that at which the terrestrial heat equals 100 degrees centigrade. If we take the augmentation of heat in descending to be one degree for thirty-three meters this will give a depth of about 3000 meters, while one part of water by weight in one hundred parts of a rock whose density is equal to 2·5, will correspond to a volume of one-fortieth. We shall now calculate the volume of this external layer which we have supposed to be thus impregnated with water, regarding it as a prism having for its base the surface of the earth, with a height of 3000 meters, which would give a mass of 1,530,000 cubic myriameters, containing 38,000 cubic myriameters of water. The total volume of the ocean being one forty-eighth thousandth that of the globe, or 225,000 cubic myriameters, it follows that this layer of 3000 meters of earth would contain a volume of water equal to one-sixth of the present ocean. Whatever may be the real value of these figures which we have adopted to render the demonstration more clear, the interest and importance of this inquiry is evident.

Miscellaneous.

THE OIL SPRINGS OF AMERICA AND CANADA.

Petroleum, Kerosene, or Rock and Well Oil.

LIVERPOOL, 15th Feb., 1862,
18 Chapel street.

RAW OR CRUDE.—Several consignments have come to hand, the finest samples showing 90 per cent. of petroline, with the density of American 46°, 790° English, the worst American 25°, 900° English, °90 per cent. of petroline. Water and pitch deposit has been found in several of the casks, which tends to deteriorate the entire parcel. Prices have ranged from £15 to £18 per ton, of 252 gallons, according to analysis and tone of the market. The demand is very large, and any sacrifice in price is met with a current sale. Some of the residuum or dead oil has been sent over, which is readily sold at £5 to £9. Heavy oil, with the burning qnalities distilled out of it, but yet containing some of the paraffin or wax, would command a sale at medium prices, and much enquiry exists for the dark lubricating oils, so freely using by the American and Canadian railways.

REFINED FOR BURNING PURPOSES.—Spite of the fiercest opposition from British manufacturers, who have lowered their prices in all directions to deter the development of the American and Canadian, steady and most successful advancement has been effected; for the infinite superiority of the latter over the paraffin oil of this country is being universally admitted. It is requisite, however, to impress upon distillers on the other side the most earnest study of empyreuma, for the sweeter the oil can be made to smell, the more will it recommend itself to our discriminating buyers. Another very important feature must be alluded to also. Most of the oil shipped as white, arrives here tinged, or if not so on arrival becomes so. This proves that before distillation the American and Canadian refiners have not aciddised and alkalied the raw: hence the pitch, remaining unprecipitated, shows itself in a colouring form, as time allows it; or else the oil gets casked! 500 casks of the Portland Kerosene Company's, and 100 casks of the New York Kerosene Company's oil, and many hundred casks of other manufacturers' which I have had to dispose of, all tinged more or less, to the great disappointment of the consignees. Let whatever refinery that is anxious for a European reputation see to this, for although white and tinged are equally saleable, the difference in value is 3d per gallon. It is an accepted assertion on both sides of the water, that a burning oil should not be lighter than American 45°, 800° English, and though I would not dissipate such a theory, yet I have in hand for sale some consignments lighter, not explosive; and some heavier, however, very explosive. Utilize the laws of explosion and inflammability practically rather than theoretically, but err on the non-explosive side, for the sale of the latter qualities is uncertain, and so far, much less remunerative. To-day's quotations for refined kerosine, 2s. for yellow; 2s. 3d. for amber and tinged; 2s. 6d. for white, with free sales.

BENZOLE.—Some parcels with this appellation have arrived, but without a trace almost of English benzole, and evidently from a matrix of quite a different origin. for it is a perfectly antipodal production—etheline I can only christen it, and what its value, and what its adaptation, has yet to be determined. To put Americans and Canadians on the scent of the true benzole, which is selling in Europe at 12s. to 13s. per gallon, I append a few remarks.

From benzole aniline is extracted. Aniline is detected by chlorine, and when obtained is rendered by oxidising into many changes. For example, salt of aniline with

Bichromate of potash gives the fixed mauve and purple dye.
Bichloride of mercury gives the fixed magenta and other reds.
Bibromide of tin gives the first fuchsiacine, &c.
Nitric acid gives the fixed azaleine, solferino, &c.
Arsenic acid gives the fixed reds and purples.
Peroxide of lead gives the fixed roseine.
Manganese salts gives the fixed pink, red, &c.
(Greens and blues are also extracted, but are as yet to be perfected.)

Each of these are of great value, 3s. to 4s. per lb.,) and only wanting economy, completely to exclude cochineal and other purple dies. The amount of aniline contained in the native or raw petroleum will depend upon the latter's base or matrix, but only abounds in the napthaline, and not in a paraffin one. From all I can gather these things are not understood in America and Canada, or I should apologise for these comments in a commercial circular; but I may perhaps be more excused doing so, when I call the attention of my readers to the words of Mr. Fairbairn, President of the British Association for the Advancement of Science in his inaugural address at Manchester the other day, when he said, alluding to the products of aniline, "it was his opinion that Great Britain, instead of receiving her dye stuffs from all parts of the globe, would, in a little time, supply the whole world."

NAPHTHA.—The American not yet developed, but English is fetching 2s. 6d. to 3s. for mineral, and 4s. 6d. to 5s. for vegetable.

Caoutchoucine, or India Rubber Solvent, much wanted, and specimens of American anxiously looked for.

Parrafin or Wax.—Sellers at 5d. per lb. buyers at 4d. per lb. for unrefined. Refined 8d. to 9d.

In conclusion, and in return for this, I shall be grateful for any American or Canadian pamphlets or circulars relating to the petroleum, and more particularly for any new facts that may present themselves in those countries. Much has to be done, many sacrifices must be made and endured, in introducing these productions ; but by perseverance and merit, undeniable happy results are in the hands of our brethren across the water, and the recipients on this.

As I shall not, in my future circulars, further allude to the chemical component parts, or adaptation of the petroleum, American and Canadian manufacturers and consumers will receive the most interesting and complete information by procuring regularly the past and future numbers of either the London *Journal of the Society of Arts*, or the *London Technologist.*

Most respectfully,
Alex. S. Macrae,
Oil and produce dealer, Liverpool.

The Nova Scotia Gold Fields.

The gold of Nova Scotia appears chiefly to exist in certain parallel lines, which probably existed in some instances almost the entire length of the Province, or to the distance of 200 miles in the direction of the strata. The most southerly or seaboard line, embraces the auriferous strata of Wine Harbor, St. Mary's, Tangier, Lawrencetown, Dartmouth, Halifax, the "Ovens,' and Lahave. A more northerly line would touch the first "diggings" near the Tangier lakes, Musquodoboit, Laidlaw's farm, and Gold River. The lines still further north are at present almost entirely unknown, and those here laid down may hereafter require adjustment on the map. The idea must not, however, be entertained that gold exists in all the quartz found upon those lines, or at other sites. There are numerous veins of that mineral everywhere that contain no gold, and it requires a practised eye and careful assay to detect it even in rich varieties of the rock.

The metamorphic group of rocks before mentioned as being extensively developed in the main land of Nova Scotia, also appears in Cape Breton Island, where gold at some future time may meet the eye of the careful observer. The same strata flank the mountains of Newfoundland and Labrador. From samples obtained at those places, the writer is inclined to the opinion that auriferous quartz is diffused along a most extended line of the British North American seaboard, and where the strata have been uplifted and entered by eruptive masses and dykes of Plutonic origin.

ASSAY OF GOLD.

An assay of a sample of gold from Tangier gave the following result from 100 parts :—

Gold	96.50
Silver	2 00
Copper	0.08
Lead	0.06
Iron	0.05
	98.69

The Gold from the "Ovens," Lunenburg :—

Gold	93.06
Silver	6.60
Copper	0.09
Iron, a trace.	
	99.75

A sample of gold assayed by J. F. Baker, Esq., Graduate of the Government School of Mines, London, after separation of the larger parts of visible gold, gave 18oz. 2dwt. 14gr. of gold per ton,

Containing fine gold	97.3
Silver	2.7

equal to 23.35 carats fine and containing, therefore, of fine gold 17oz. 12dwt. 19gr., $352.66, and fine silver 19dwt. 19gr., equal to fifty cents, total $358.16.—*Dr. Gesner.*

More recently Dr. Gesner, the author of the foregoing paragraphs says :—

In the central portions of Nova Scotia there are extensive ranges of granite and other rocks varying in height from 500 to 1,000 feet above the level of the sea. Metamorphic rocks of great thickness lean against the granite, and these are succeeded by the silurian and coal formations and trap rocks. Dr. Gesner informs us that "the gold has only been discovered in the metamorphic rocks which touch the granite on one side and the silurian on the other." At Tangier, gold was accidentally discovered, in 1860, in a small stream flowing into the Atlantic about fifty miles from Halifax. Gold is found in this place in quartzite, metamorphic clay, and greywacke. In form it resembles rough, feathery metal obtained by pouring any molten metal among cold water. The average yield of gold to the ton of ore is not stated, but about 600 miners were employed at this place last summer. Seven other diggings were visited, but the description of Tangier would nearly apply to them all, with the exception of "The Ovens," which seems to be a curious place. The name has been given to the locality on account of large and peculiar excavations made in the rocks by the sea. They are formed in a peninsula which is about one mile in length by a half in breadth, jutting out into Lunenburg Bay. The precipices are about fifty feet in height above the water, and the southern side of the peninsula is principally composed of metamorphic slate containing thin seams of quartz in which the gold is found mixed with sulphurets of iron, mispickel and mica. In one of the caves in "The Ovens" considerable quantities of gold have been washed by hand from the sands on its floor. The amount of gold obtained at this place, without machinery, from June to December, 1861, was valued at $120,000. It varies in size from small spangles up to rough pieces about the size of a walnut. By Dr. Gesner's assay Tangier gold contains 96.50 of pure metal and 2. of silver. The gold of "The Ovens" contains 93.06 of gold, and 6.60 of silver.

Of the gold yielding rocks of Nova Scotia, Dr. Gesner says:—The Province contains an ample amount of the precious metal to warrant most extensive operations and the construction of machinery for its mining and purification.

Overland Telegraph to India.

The last published part of the Proceedings of the Royal Geographical Society contains Sir Henry Rawlinson's communication on a direct overland

telegraph to India, from which we gather a few interesting particulars. A telegraph, 1,314 miles in length, is in operation from Constantinople to Bagdad, being no inconsiderable part of a line which the Turkish government erected at its own cost, intending to carry it on to Bussorah. From the latter place, Sir Henry Rawlinson recommends that it should be extended to Teheran, thence to Ispahan, Shiraz and Bunder Abbas, at the head of the Persian Gulf; and from there along the coast, through the territories of the Imaum of Muscat and the Khan of Kelat, to Kurrachi, where the line would meet our Indian telegraph system. "Teheran," as we are informed, "has peculiar advantages as a principal station; first, because a line passing that way would be sure of the favor of the Persian Government; and, secondly, because it would there be connected with other lines of telegraphs. An electric communication is already established between Teheran and Tabriz, while Persian telegraphy seems likely to progress, and to connect itself with the Russian system by way of Tiflis, and even with our Scindian frontiers, by way of Herat." The distance from Bagdad to Bunder Abbas would be 1,302 miles; from Bunder Abbas to Kurrachi, 731, making the whole distance from Constantinople to India, 3,351 miles. There is much to be said for an overland telegraph to the far East. It can be more easily repaired than a submarine cable, and it appears the Arabs are not unfriendly to the presence of English enterprise in the desert in such a form. One of the chiefs said to our consul at Diarbekir, "If in your hands, yes; but if in the the hands of the Turks, we should destroy it, looking upon it but the forerunner of forts and soldiers to coerce us." Should this scheme be accomplished, as we hope it will, London would be able to communicate directly with Calcutta, and we should have a line rivalling that which now stretches all across the great continent of North America, from New York to San Francisco. We notice in the last news from South Africa that a telegraph line is to be set up from Cape Town to Graham's Town, and that extensions to Natal and Caffraria are talked of.—*English Paper.*

The Trade of the Lakes.

The quantity of grain received at Buffalo during the 253 days of navigation, is immense, as the figures will attest, and is divided as follows:

Flour, barrels	2,135,308
Wheat, bushels	26,683,337
Corn, "	20,986,440
Oats, "	1,801,240
Rye, "	356,370
Barley, "	282,350
	50,109,647
Reducing flour to wheat would give	10,766,540
Making a total of	60,876,187

Add to this the flour and grain received during the year by railroad, and the grand total for 1861 will be over *sixty-two millions* of bushels! No port in the world ever saw the equal of this.

To elevate and discharge this grain, we have seventeen elevators, with capacity of storage varying from 120,000 to 600,000 bushels, and an aggregate of 3,500,000 bushels. Each of these can elevate from a vessel 4,000 bushels per hour. Three new ones, now in process of erection, will give us, next year, storage room for 4,000,000 bushels.

The estimated amount of flour and grain at all the Lake ports west of this State, for the season of 1861, is 113,000,000 bushels; of which there has been received at Buffalo, 62,000,000 bushels; at Dunkirk, 3,500,000. at Oswego, 18,000,000; at Ogdensburgh, 3,500,000; at Montreal, 15,000,000; making a grand total of *one hundred and two millions bushels* sent from the granaries of the West

The quantity in store here is 1,500,000; Chicago, 3,500,000; Milwaukie, 1,500,000; all other Lake ports, about 3,000,000 bushels. Total now in store say 9,500,000 bushels.—*Buffalo paper.*

Commerce of Montreal.

The clearances of sea-going craft from the port of Montreal, for the season of 1861, showed 494 vessels, representing 250,281 tons, against 229 vessels, of 116,748 tons, for 1860. The principal ports to which produce was exported were:

	1860.		1861.	
	Vessels.	*Tons.*	*Vessels.*	*Tons.*
Liverpool	73	68,067	146	126,326
Glasgow	34	22,097	68	45,883
London	19	7,770	57	27,551
Gloucester	14	4,222	20	7,686
Bristol	8	2,392	20	8,532

Ship Canal across the Isthmus of Darien.

Several French engineers, under the direction of M. Bonardiol, have made a partial exploration of the Isthmus of Darien, and are to sail for Darien, again, to make a detailed survey of the line for a ship canal between the Atlantic and Pacific Oceans. There is thus, at length, a prospect of this grand project being carried into execution. The line about to be surveyed, which was discovered by Dr. Cullen, in 1849, after several long and perilous explorations in different directions through the forests, extends from the gulf of San Miguel, on the Pacific, in a direction N. E. by E. ½ E. by compass, to Caledonia Harbour and Port Escoces on the Atlantic. The Gulf of San Miguel receives numerous rivers, the largest of which are the Tuyra and the Savana, which unite together just before falling into it. The Savana is navigable for the largest ships up to the confluence of the Lara with it, that is for fourteen miles towards the Atlantic. From the confluence of the Lara with the Savana, at which point the future canal will commence, the line extends to the Chuquauaqua, a distance of 12 miles. From the Chuquanaqua the line follows the bed of the Sucubti, one of its tributaries, up to the confluence of the Asmati with the Sucubti, a distance of nine miles; and then continues along the bed of the same river Sucubti to a point nine miles higher up. From that point to the Atlantic the distance is six miles. The whole length of the projected canal will therefore be 35 nautical, or nearly 41 English miles.

Improvements in Candles.

It is said that if the cotton wick be steeped in a solution of nitrate of potassa, or chlorate of potassa, and then thoroughly dried before the tallow is melted around them, a purer flame and brighter light are obtained than when made in the ordinary manner. Snuffing is not so frequently required, nor do the candles, thus prepared, run.

The Allotropic State of Phosphorus and Iron.

Perhaps the most valuable use that is made of the power of putting substances into an allotropic state, is in the manufacture of friction matches. Phosphorus takes several allotropic conditions, in one of which it is known as red phosphorus. In this state it does not take fire from friction, nor does it emit the deleterious vapors which have produced such frightful effects upon persons employed in match manufactories. The phosphorus is, accordingly, by exposure to light under certain conditions, and other manipulations, passed into the allotropic condition of red phosphorus, when it can be transported or handled with impunity. In this state it is used for making matches; and it then slowly returns to its normal conditions.

By several processes iron can be thrown into an allotropic condition, which has been called the passive state. In this state it is not acted upon by nitric acid, and its properties vary in several particulars from those which it ordinarly exhibits. If a piece of iron is put into nitric acid of specific gravity of 1, 3, it dissolves freely with effervescence, but if a piece of platinum wire be placed in the acid, and then the iron be introduced in contact with the platinum, the acid will not now act upon the iron, even if the platinum is withdrawn. Another piece of iron put into the acid in contact with the previous piece, will become effected in the same way, and so on with a third or more pieces. Another mode of making iron passive is to oxidize one end of the piece in the flame of a lamp. It may also be effected by making it the positive pole of a battery, by a blow, and in other ways. A piece of passive iron can be restored to its normal condition by rubbing it, or by bringing it in contact with active iron.

The allotropic state of substances is a comparatively new and very inviting field for chemical research.

Marine Disasters.

The British Board of Trade report for the year 1860 gives the per centage of disasters as compared with voyages, as follows:—For the eight years, from 1852 to 1860, $\frac{47}{100}$ of one per cent, or one accident in every two hundred and thirteen voyages; and for the year 1860 alone $\frac{53}{100}$ of one per cent., or one in every one hundred and eighty-eight voyages. This per centage includes accidents of every kind, great and small, and the voyages include over-sea and coasting. On the other hand, the proportion of accidents to American ships to the number of voyages is, as near as can be estimated with the imperfect data at command, for the year 1860, 1 $\frac{33}{100}$ per cent., or one accident of some kind in every seventy-five voyages. This, it will be seen, is more than double the per centage for English ships.

International Cattle Show, 1862.

The Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland have jointly arranged to conduct an International Cattle Show in London next summer, and Battersea-park has been granted for the purpose, where the necessary enclosure and buildings will be made. The show will take place during the week commencing the 23rd of June, 1862.

Permanency of the Steam Engine.

At present it seems improbable, so long as motive power is to be obtained through the intervention of heat, and until a cheaper fuel than coal can be found, that the steam engine will be superseded by any other machine.

Electric magnetic machines are perhaps the least likely of all inventions to supersede the steam engine. The consumption of a grain of zinc, as Mr. Joule has shown, though much more costly than a grain of coal, does not produce more than about one-eighth of the same mechanical effect.

It would not, however, be at all safe to predict that considerable improvements may not yet be made in the steam engine, or in engines to be worked by coal.

The consumption of fuel in the best steam engines has been reduced to 2½ pounds of coals per horse-power per hour; but such an engine does not utilize one-fifth part of the absolute mechanical value of the coal consumed, and so long as this is the case, it would be unwise to assume that we have attained the utmost limits of improvement.

Improvements in Screw Steamers.

In 1848, the fastest screw line-of-battle-ship in the navy could not steam more than seven and a half knots, or eight miles and two-thirds per hour, whereas the *Warrior*, though clothed with an outer coat of iron armour four inches and a half thick, at her trial in October last over the measured mile in Stokes Bay, attained an average speed of 14·356 knots, or 16·533 miles per hour, beating the *Howe*, which previously had attained the highest trial speed of any of Her Majesty's line-of-battle ships.

A new Atlantic Telegraph.

It is proposed to renew the attempt to cross the Atlantic with an electric cable. The government of the United States are to pay one half of the cost and supply their share of necessary vessels if the government of Great Britain will be responsible for the other half of the expenses incident to this difficult undertaking.

Galvanizing Cast Iron.

The *Moniteur du Commerce* says that all the difficulties of coating cast iron with copper by the galvanic process have been overcome by Mr. Oudry, of Paris, by the simple process of varnishing the iron before placing it in the bath. The *Moniteur* states that there are in the *Bois du Boulogne* three kinds of candelebra, the first in bronze, the second in cast iron painted, and the third in cast iron covered with copper by M. Oudry's process; and those of the last kind alone have preserved their lustre. "They are as brilliant and perfect as at the moment of coming from the workshop." The kind of varnish employed is not given.

Dianium.

Dianium is the name given to a new metallic element discovered by M. von Kobell. In March, 1860, he found a new metallic acid, which he termed dianite, in extracts from the tantalites of Tammela. From this, by chemical reactions, he has obtained dianium, the fourth new element, the preceding being cæsium, rubidium, and thallium.

Gold in Nova Scotia and New Brunswick.

His Excellency the Governor of New Brunswick, states in his speech at the opening of the New Brunswick Parliament, that the Imperial Government were agreed to sanction any "well considered" arrangement for facilitating commercial intercourse between the different provinces of British North America, and promises to lay the correspondence which has taken place upon the subject before the House. The extensive discoveries of gold are noticed, and the Parliament informed that the geological formation of the country not unreasonably induces a belief that similar discoveries may be made in New Brunswick. His Excellency therefore recommends the consideration of such amendments as "may be needed in the existing laws relative to mining operations, in order to meet the requirements of such a contingency.

The Great Underground Treasury.

The wealth of England is so intimately connected with her mineral resources, that like a careful trader she annually "takes stock" of all her operations, and publishes the returns—having no reason to be ashamed of them—for the information of the world. Our capital, our machinery, our skilled artizans, might all emigrate, if our home-born supply of coals and iron were to fail. The materials could, indeed, be brought to us from abroad, but it would be cheaper still, as the prophet found it of old, to go to the uncomplying mountain. When we visited Swansea in 1848, there were ships in her docks laden with Australian copper ore, and ship-loads encumbered the quays. Cottages ornamented their window-sills with malachite and azurite, and bordered their garden-plots with the green and blue mineral. It is not so now; the colonists import our coal instead of sending us their ores, and the produce of the Burraburra is smelted at the mines. Sir Henry de la Beche, in the Inaugural Discourse at the opening of the School of Mines, in November, 1851, valued the mineral produce of Great Britain and Ireland at twentyfour million pounds per annum, or about four-ninths of that of all Europe, including these islands; an amount more than three times greater than the mining produce of Russia and Poland, and four times that of France. In Mr. Hunt's "Mineral Statistics for 1860." the returns exhibit a total amount of thirty-seven millions, exclusive of the building-stone, brick earth, and similar materials, estimated in the statistics of the previous year at nearly eight millions sterling. The coal returns for England and Wales, during the year 1860 show an extraordinary increase. It may be remembered that in Mr. Hull's "Coal fields of Great Britain," the coal raised in 1858 was stated to be 57 million tons, and the *present and future* produce was estimated at 60 millions. Upon this assumption, the coal fields of England and Wales, it was calculated, would last 1,000 years; whereas upon our estimate of the present rate of *annually increasing* consumption, we should exhaust all our available coal in the space of a century. The actual produce of 1859 was 61½ millions of tons; and last year it mounted up to 69 millions, or with the addition of the Scottish coal mines, to 80 millions; besides which, there were four million tons of small coal left useless on the pit banks. At this rate there can be little doubt we shall raise 90 million tons of coal by the year 1862; and the only check we can anticipate is the overgrowth of the mining population already estimated at half-a-million by Professor Morris in his recent lectures on coal. The total amount of coal exported in the year 1860 was 6,788,060 tons, being little more than the total of the preceding year; while the exportation to France has experienced a slight falling off. Next to coal, the most important articles are copper, iron, lead, and other metals, the value of which will be shown most readily by Mr. Hunt's summary of the mining produce of Great Britain and Ireland for two years.

	1859.	1860.
Coal	£17,994,951	£20,010,674
Iron	11,138,712	12,703,950
Copper	1,734,700	1,706,291
Lead	4,410,095	1,417,415
Tin	929,390	871,382
Silver	159,507	151,173
Zinc	75,782	89,537
Other minerals	95,000	170,927
	£33,538,027	£37,121,318

The Critic.

Gold in the Saskatchewan.

The Red River *Nor-Wester* states that gold has without doubt been discovered on the eastern slope of the Rocky Mountains as low down the North Branch of the Saskatchewan as Carlton. Parties are organizing for a journey to the Rocky Mountains and British Columbia, at Selkirk Settlement, in many parts of Canada, and Minnesota. No doubt this summer will witness an attempt to establish an overland route through British territory *to the gold fields* of our sister colony.

Wood for Shipbuilding.

Professor Crace Calvert is now making an investigation for the Admiralty of different kinds of wood used in ship-building. It appears that the Professor is at no loss to explain why so many of the fleet of recently-constructed gunboats became rotten and others escaped untouched. He finds the goodness of teak to consist in the fact that it is highly charged with caoutchouc; and that, if the tannin be soaked out of a block of oak, it may then be interpenetrated by a solution of caoutchouc, and thereby rendered as lasting as teak. A few years ago an enterprising individual spent £30,000 in trying to introduce a new wood for shipbuilding purposes from South America, where it is known by the name of Santa Maria; but the dockyard authorities could not be persuaded to take it into use, and the imports were entirely neglected. This is one of the specimens investigated by the Manchester professor; and he finds it to be sound and resinous, and but little inferior to teak. Of the durability of teak there can be no question.

It is proposed to erect a Crystal Palace in Paris on the plan of that at Sydenham, A company with a capital of 25,000,000fr. is in course of formation: Sir Joseph Paxton is at the head of the architectural department, Mr. Edwin Clarke is appointed consulting engineer, and Mr. Thomas Brassey is to be the contractor. The building is to be erected in the Bois du Boulogne.

To Ascertain the Weight that may be safely borne by Columns of various Dimensions and Materials.

RECTANGULAR COLUMNS.

Cast Iron, $$\frac{16000\ l\ b^2}{4\ b^2 + \cdot 18\ l^2} = \text{W}.$$

Wrought Iron, $$\frac{18000\ l\ b^3}{4\ b^2 + \cdot 16\ l^2} = \text{W}.$$

Oak, $$\frac{4000\ l\ b^2}{4\ b^2 + \cdot 5\ l^2} = \text{W}.$$

SOLID CYLINDERS.

Cast Iron, $$\frac{10000\ d^4}{4\ d^2 + \cdot 18\ l^2} = \text{W}.$$

Wrought Iron, $$\frac{11200\ d^4}{4\ d^2 + \cdot 16\ l^2} = \text{W}.$$

Oak, $$\frac{2500\ d^4}{4\ d^2 + \cdot 5\ l^2} = \text{W}.$$

HOLLOW CYLINDERS.

Cast Iron, $$\frac{16000\ \text{D}^4 - d^4}{4\ \text{D}^2 + \cdot 18\ l^2} = \text{W}.$$

Wrought Iron, $$\frac{11200\ \text{D}^4 - d^4}{4\ \text{D}^2 + \cdot 16\ l^2} = \text{W}.$$

Oak, $$\frac{2500\ \text{D}^4 - d^4}{4\ \text{D}^2 + \cdot 5\ l^2} = \text{W}.$$

l represents the length in feet, b the breadth, and D and d the diameter in inches, and W the weight in pounds.

EXAMPLE.—What are the crushing weights that may be safely borne by a cast iron, wrought iron, and oak rectangular column 2 in. square and 5 ft. in height?

$$\frac{16000 \times 5 \times 2^3}{4 \times 2^2 + (\cdot 18 \times 5^2)} = \frac{16000 \times 5 \times 8}{32 + 4\cdot 5} = 17534 \text{ lbs.}$$

for the cast iron.

$$\frac{18000 \times 5 \times 2^3}{4 \times 2^2 + (\cdot 16 \times 5^2)} = \frac{18000 \times 5 \times 8}{32 + 4} = 20000 \text{ lbs.}$$

for the wrought iron.

$$\frac{4000 \times 5 \times 2^3}{4 \times 2^2 + (\cdot 5 \times 5^2)} = \frac{4000 \times 5 \times 8}{32 + 12\cdot 5} = 3596 \text{ lbs.}$$

for the oak.

Table exhibiting the Relative Value of various Woods, their Crushing Strength and Stiffness being combined.

Spanish Mahogany	2571	American Spruce	2522
Teak	6555	Walnut	2378
English Oak	4074	Yellow Pine	2193
Ash	3571	Larch	1897
Elm	3468	Sycamore	1833
Beech	3079	Poplar	975
Quebec Oak	2927	Cedar	700

Comparative Strength of Long Columns of various Materials.

Cast Iron	1000	Oak	108·8
Wrought Iron	1745	Pine	78·5
Cast Steel	2518		

Artizan.

STEAM ON COMMON ROADS.—On the 21st ult., a heavy marine boiler was successfully removed from the works of Messrs. John Laird, Sons, and Co., Birkenhead, to the large crane situate on the margin of the Great Float, by means of Taylor's (Britannia Engine Works) "steam elephant," and a second boiler was removed on the 24th ult. This is the first instance in this neighbourhood in which steam on common roads has been employed for such a purpose. Judging from the easy manner this machine was guided over roads in a very indifferent state, and the distance it had to travel, it promises to become a most useful agent for transporting heavy loads, and it is equally applicable for discharging timber out of ships and afterwards drawing it upon the quay or from place to place, as required. One of these engines, manufactured by Messrs. J. Taylor & Co., of Birkenhead, has been at work for this purpose in her Majesty's dockyard at Devonport, for upwards of two years, with great success.—*Artizan.*

BRITISH SHIPS AND BRITISH SEAMEN.—The mercantile marine of the British Empire consists of 35,501 vessels, measuring 5,710,968 tons, and navigated by 294,460 seamen. The various divisions of the United Kingdom, and the British Possessions abroad, furnish the annexed figures in connection with the preceding statement:—

	Vessels	Tons.	Crews.
England	21,007	3,709,615	168,415
Scotland	3,486	623,791	31,682
Ireland	2,271	253,336	14,109
Guernsey, Jersey and Isle of Man	899	71,045	5,591
British Possessions	10,338	1,052,281	74,663
Total	38,501	5,710,968	294,460

Of the above vessels, 2,337, with 500,144 of tonnage, are propelled by steam.

Lucifer Matches.

Mr. Gore, a recent writer on this subject, gives some interesting statistics respecting this branch of manufacture. The firm of Messrs. Dixon employ 400 workmen, and generally have on hand £8,000 or £10,000 worth of timber. Each week they consume one ton of sulphur and make 43,000,000 matches, or 2,160,000,000 in the year. Reckoning the length of a match at two and a quarter inches, the total length of these would far exceed the circumference of the earth. Another calculation has been made, that the whole length of waxed cotton wicks consumed every year by one London manufacturer in the production of "vestas," would be sufficient to reach from England to America and back again. The magnitude of the figures relating to the English manufacture of matches is, however, insignificant, when we turn to the Austrian production. Two makers alone, M. Pollak, at Vienna, and M. Furth, in Bohemia, produce the amazing number of 44,800,000,000 matches yearly, consuming twenty tons of phosphorous, and giving employment to 600 persons. The low price at which these necessaries of life are produced is equally astonishing. M. Furth sells his cheapest boxes at one penny per dozen, each containing eighty matches. Another maker sells the plain boxes at two pence per 100, and 1,400 matches for one farthing; whilst

a third maker sells a case of fifty boxes, each containing 100 lucifers, for four pence. The imports of matches into the United Kingdom are of the value of £60,000 yearly, representing the enormous number of 200,000,000 daily. The daily consumption is 50,000,000 more than the above number, or upwards of eight matches each day for every individual in the kingdom.

How to Pack Fruit.

The following is the method of packing fruit and flowers employed by Mr. Kidd, the gardener of the Marquis of Breadalbane, in England. He says:—"A box is chosen, in size, according to the quantity to be sent. A layer of dry bran is put at the bottom; then each bunch of grapes is held over the centre of a sheet of soft paper; the four corners of the paper are brought up to the stalk and nicely secured; then laid on its side in the box, and so on, until the first layer is finished. Then fill the whole over with bran, and give the box a gentle shake as you proceed. Begin the second layer as the first, and so on till the box is completed. Thus, with neat hands, the bloom is preserved, and may be sent to any distance; but, with clumsy hands, quite the contrary, and often an entire failure, as the putting in and taking out of the box are the most important points to be observed."

He has pursued this system of packing fruit for twenty years, and it was sent five hundred miles by inland carriage from England to the highlands. He has invariably packed sixty or eighty bunches of grapes and fifty or sixty dozen of peaches or apricots in one box, and they arrived as safe and fresh as when taken from the trees.

To Remove Clinkers from Stoves.

Some kinds of coal are liable to form clinkers which adhere to the fire-brick lining of stoves, grates and furnaces, and become a source of great annoyance, as they cannot be removed by usual means without breaking the fire-brick. Persons who are thus annoyed will be glad to know that by putting a few oyster shells in the fire close to the clinkers, the latter will become so loose as to be readily removed without breaking the lining.

Monster Photographic Lens.

Perhaps the largest lens in the world has just been completed by Mr. Dallmeyer for the government establishment at South Kensington. It is a triple achromatic combination of sixty inches focal length, for the production of pictures three feet square. It consists of three combinations, the front and back being six and eight inches diameter respectively, whilst the diameter of the central or negative combination is four inches in diameter.—*London Review.*

Auriferous Rocks of Victoria.

The area of the quartz-bearing rocks at Victoria, in Australia, is estimated at 25,000 square miles. The total area of the extent of land at present mined upon in that colony is 561 square miles. Thus 89,920 square acres, have produced gold to the amount of £92,787,236, on an average of about £1,032 per acre, and there yet remains upwards of 15,000,000 acres almost every where intersected by quartz veins of greater or less thickness, which are as yet intact by the pick of the miner.

Light.

"Light, or rather the absence of it, can hardly be said to determine, in any important degree, the distribution and limitation of the lower forms of animal life. Light is not essential even in the case of some of the higher orders. A large class of creatures, both terrestrial and marine, possess no true organs of vision, although there is good reason for believing that they do possess some special sensory apparatus susceptible to the influence of light; whilst certain creatures, whose habitation is in subterranean caves or lakes, as in the Magdalena near Adelsburg, and the Great Mammoth caves in Kentucky, either possess no organs of vision or possess them in so rudimentary a state, as to prove clearly that the absence or imperfect development of the sense may be compensated for by the higher development of other senses. It is impossible at present to say to what depth light penetrates in the sea. The photographic art will, no doubt, one day solve the problem. But it is almost certain that a limit is attained, and that, moreover, long before the deep recesses gaged by the sounding machines are reached, where the light-giving portion of the ray cannot penetrate even in its most attenuated condition; and yet, as shall hearafter be shown, creatures have been found down in those profound and dark abysses whose coloring is as delicate and varied as if they had passed their existence under the bright influence of a summer sun."—*Wallech, British Association.*

Foreign inventions.

Permanent Aniline Colors.—R. H. Gratrix, England, has applied for a patent for rendering printed and dyed aniline colors permanent. The cloth is first prepared with stannate of soda, then passed through a thickened solution of tannin, after which it is either printed or dyed with the aniline color (magenta, solferino, mauve, &c.), then subjected to the action of steam. Aniline colors have not yet been rendered permanent, so far as it relates to the action of sunlight upon them. They change rapidly under solar influence, but can be washed without fading.

Dressing Flax.—In the dressing of flax and other similar fibres, it has been customary to employ drums armed with teeth set at right angles to the surface of each revolving drum. A patent has been obtained by A. Smith, London, for setting the teeth on such drums pointing in a reverse direction to that in which the cylinder is driven. By thus setting the teeth of such drums at a reverse angle to those in common use, the fibres, it is stated, are not so much injured, therefore less tow is made and more good fibre secured. In combination with the drum, Mr. Smith uses an apron, hinged at the bottom end of the case. This apron is hollowed out on the inside and armed with brushes, so that the attendant can feed the flax in a superior manner to the action of the revolving machine.

To Clean Paint.—Smear a piece of flannel in common whiting, mixed to the consistency of common paste, in warm water. Rub the surface to be cleaned quite briskly, and wash off with pure cold water. Grease spots will, in this way, be almost instantly removed, as well as other filth, and the paint will retain its brilliancy and beauty unimpaired.

Silvering Glass.—J. Cimeg, patentee. A solution of ammonia, nitrate of silver and tartrate of soda is applied to the surface of the glass, when the metal is soon deposited in a bright film at the ordinary temperature of the atmosphere. This is considered to be, perhaps, the most simple method of depositing silver on glass yet discovered. Other modes require the application of high heat to produce the deposition of the metal from a nitrate solution.—*Scientific American.*

Fire Insurance in London.

At the annual meeting of the shareholders of the Royal Insurance Company, Liverpool, it was stated that a meeting of all the officers engaged in fire insurance in London had recently been held, consequent on the late great fire, at which it was agreed to advance the rate of premium on commercial insurance to a considerable extent. Subsequent reflection, however, had shown that a modification of the proposed rise would be sufficient; and Mr. Dove, the manager of the Royal Company, was of opinion that these modified rates would be found sufficient to meet all contingencies. He proceeded to say, that within the last seventeen years 580 new insurance offices, of all kinds, had been projected. Of these, 233 had ceased to exist in the same period, 11 had amalgamated with other companies, 134 had transferred their business, and 42 were winding up their affairs in chancery. Of the whole number, 95 fire offices had discontinued business. Within the last seventeen years 48 fire offices had been established. Of these, only 12 survive, 36 having discontinued business; and, in all, there are only 52 fire offices now doing business.

Cattle in Buenos Ayres.

In the three *Partidos* of the province of Buenos Ayres alone, there were, according to the returns of 1858, 3,875,742 horses, 8,672,675 oxen and 1,385,280 sheep. In the year 1838 the number of horned cattle did not exceed four millions; but since the pampas south of the Salado has been cleared of Indians, and the country in general become more settled, the above enormous increase has taken place. The same with the sheep, the wool of which was formerly so coarse that it was only fit for carpets: whereas, since the improvement of the breed by a cross with fine-woolled sheep, it is largely exported for finer manufactures. The exportation for 1858 consisted of 969,604 dry and 318,304 salted ox-hides, 68,874 dry and 120,757 salted horse-hides, wool to the amount of 37,423 fardos, tallow, 240,362 cwt., besides horns, oil, bones and hair. The number of ships in which these were exported was 404.

Steamships for the Montreal Ocean Steamship Company.

Messrs. R. Steele & Son, of Greenock, have turned out a screw of 1,400 tons, named the St. George, 253 feet long, 33 feet 6 inches broad, and 22 feet deep. The St. George, which will be fitted with engines of 175 horse-power, has been built by Messrs. J. &. A. Allan, of the Montreal Ocean Steamship Company, and is intended to ply between Glasgow and Montreal. A similar screw, built for the same owners by Messrs. Barclay, Curle & Co., of Whiteinch, is as nearly as possible of the same tonnage and dimensions, and has received the name of the St. Andrew; she is to be fitted with engines by the same firm, of 150 horse-power, and will also run between Glasgow and Montreal.

The extent of the Oil Region in America.

The oil region comprises parts of Lower and Upper Canada, Ohio, Pennsylvania, Kentucky, Virginia, Tennessee, Arkansas, Texas, New Mexico, and California. It reached from the 65th to the 128th degree of long. W. of Greenwich, and there are outlying tracts besides.

Rocks of Silurian, Devonian and Carboniferous age yield this material, which is rapidly becoming one of the most important natural productions of the continent, and is likely to exercise a very extensive influence upon the comforts and civilization of mankind.

Phosphorescence.

The experiments of M. De Reichenbach tend to prove that phosphorescence is a usual consequence of all molecular phenomena, and not the result of combustion or oxidation. Mr. Phipson proved this last point some time ago, when he showed that dead fishes shine in the dark, even under water, and in the absence of oxygen.

According to M. De Reichenbach there is phosphorescence during fermentation or putrefaction, crystallisation, evaporation, condensation of vapours, the production of sound (vibrations therefore), and the fusion of ice; a considerable glow is remarked when a galvanic pile in activity, a block of ice in fusion, or a solution of sulphate of soda in the act of crystallising is observed in the dark.

The human body itself is not devoid of phosphorescence: in a healthy state it emits a yellow glow; when in ill-health the glow becomes red. The author considers that this observation may possibly be of use in diagnosis.

To perceive these phenomena the eye ought to have been previously rendered sensitive by remaining some hours in perfect darkness, and even then all eyes are not equally impressionable. But, if several persons unite in performing the experiment together, there will always be a certain number who are able to see the phenomena.

These facts of the production of light remind the author of observations published some time ago, by M. Wullner, according to which every molecular movement is accompanied by a disengagement of electricity.—*Poggendorff's Annalen*, vol, cxii., p. 459.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

APRIL, 1862.

IRON ARCHITECTURE.

(*For the Journal of the Board.*)*

The employment of cast-iron for the fronts of buildings in cities, has not only rendered cheap and practicable a far greater amount of tasty ornamentation than heretofore; but singular as the proposition may seem, has actually rendered such architectural display, or some variation in the surface, essential to the obtaining of a proper degree of strength. Economy of material dictates that the actual thickness of an iron wall shall be very moderate, and in some of the first applications of wrought iron to this purpose, the walls, flat, plane, and consequently very weak, were so cracked and distorted on the occurrence of a fire, either without or within, that its use was almost abandoned. Some of the first in California thus failed, but cast-iron buildings are so profusely filled with pilasters cornices, lintels, and various other angular and curved projections and recesses, that the metal has everywhere liberal opportunity to spring, and expand or contract to any required degree, and the leverage of the parts to resist any lateral force is also increased to nearly as great an extent, as if the walls were made solid to that thickness. The practical thickness therefore, of the present styles of iron fronts is about eighteen inches, measuring for this purpose from the front of the pilasters and window caps to the recesses of the windows, while the actual thickness of the castings is nowhere intentionally made more than five-eighths of an inch, and many castings are less than three-sixteenths.

The popularity of cast iron for buildings is sufficiently evident, whether we inspect the principal streets of any of our chief cities, or note the activity in the establishments specially devoted to such constructions. In Canada, there is no one establishment which we can say is specially devoted to such manufactures, but when the writer was in New York last summer, he was in D. D. Badger & Co's, who employ over four hundred men, and although a part of the work of this company is the manufacture of iron shutters, more than nine-tenths of this force is engaged in the designing, patterning, moulding, cleaning, finishing, oiling, painting, transporting, and erecting of iron buildings.

* Communicated.

In this last sentence is briefly analyzed the whole construction of an iron front. Some of the processes are obvious enough, but others may need explanation. A professional architect usually works out a design which in some of its features is incapable of production in iron. The first step of the constructor, then, is to alter the design, until all the parties are suited. The next is the detail drawing and pattern making, necessarily a large portion of the labor, although as the art advances and stocks of the patterns are increased, a large number of parts will be but duplicates of shapes and sizes before in existence, and therefore require little or none of this labor. Upper stories now generally resemble the lower portions, except that the height is diminished by carving off the pattern in the middle, and removing a part, and some of the smaller ornaments, especially the leaves on the Corinthian Capitals (Corinthian, is a favorite style by the way, in these buildings) are cast separately, and attached by screws or rivets. The casting is conducted in the usual manner, but the long flasks are mostly of iron, and the metal is poured at as high a heat as practicable, to ensure its filling completely the broad thin cavities. Cleaning the large, and "tumbling" the small parts are processes familiar to every body, as are also the planing and slabbing by machinery, and the more primitive processes of chipping and filing, which to save handling is often permitted to suppersede the machine work.

The establishment mentioned above is a fine building. The main shop is 300 feet long by 60 feet wide, and five stories high. The ground floor where all the heavier parts are finished, has two lines of railroad (21 inch guage) extending its whole length, and is studded with cranes to facilitate the handling of the pieces. The drilling and fitting being here completed, each part is oiled and painted. All the small parts are *boiled* in oil, by which we mean immersed in oil, at nearly its boiling or rather "frying" point, and allowed to remain in this bath until it has become thoroughly heated. This process is believed to so effectually fill the pores of the metal as to very materially add to its durability. Cast iron is very readily preserved, but the wrought iron screws or rivets, oydize with more avidity; and this heating in linseed oil has been adopted as the best method of defence, and as contributing, as far as possible to make iron buildings absolutely unaffected by time. In addition to this oleaginous filling of the pores, the surfaces are painted once in the shop, and again twice after placing in the building before the work is finished.

Iron buildings properly constructed, combine

unequalled advantages of ornament, strength, durability and economy, while they, at the same time afford a larger amount of useful interior space in a given size, (an important point in a densely crowded city), and are tolerably secure against danger from fire, lightning, or an unequal settling of the foundation. The parts are fastened together much more firmly than any mortar or cement has ever proved in practice, capable of joining stone or brick.

Different methods of joining the parts are adoptted by builders. One very desirable plan is to join the whole firmly, so that it is in effect a unit, but as this has induced timidity in some, in consequence of the great range such a front would take, should it be loosened from the side walls, and fall outwards. A gentleman in New York invented and patented a very simple and admirable means, by which the front falls, *one story at the time and always inward*, upon the burning ruins, instead of upon the street.

Iron buildings are always built by contract. The cost of such iron structures, or in fact of any other varies so greatly that it may appear idle to attempt to estimate the comparative expense. Calculating from the actual contract prices of a number, however, the following is a rough approximation. City lots are generally 25 feet wide on the street; a front of this width, 5 story high, would cost in Montreal as follows :

Wood (forbidden by law)	$——
Brick (face brick)	2500
Brown stone (a kind of sand stone)......	3500
White marble.................................	4000
Granite	4000
Iron (elegant style) from $ 3000 to ...	5000

In this article attention has been confined to the fronts alone. The construction of absolutely fire-proof buildings require brick and iron floors, etc., which it is unnecessary now to enter upon, but which may or may not be used in what are termed iron buildings.

PROGRESS OF GEOLOGY.

(*Continued from page 74.*)

In the last year, Mr. Barrande has most ably compared the North American Taconic group of Emmons* with his own primordial Silurian fauna of Bohemia, and other parts of Europe; and although that sound palæontologist, Mr. James Hall, has not hitherto quite coincided with Mr. Barrande in some details,† it is quite evident that the primordial fauna occurs in many parts of North America. And as the true order of succession has been ascertained, we now know that the Taconic group is of the same age as the lower Wisconsin beds described by Dale Owen, with their Paradoxides, Dikelocephalus, &c., as well as of the lower portion of the Quebec rocks, with their Conocephalus, Axionellus, &c., described by Logan and Billings. Of the crystalline schists of Massachusetts, containing the noble specimen of Paradoxides described by W. B. Rogers, and of the Vermont beds, with their Oleni, it follows that the Primordial Silurian Zone of Barrande (the lower Lingula flags of Britain) is largely represented in North America, however it may occupy an inverted position in some cases, and in others be altered into crystalline rocks.

In determining this question due regard has been had to the great convulsions, inversions, and breaks, to which these ancient rocks of North America have been subjected, as described by Professors Henry D. and W. B. Rogers.

In an able review of this subject, Mr. T. Sterry Hunt thus expresses himself:—"We regard the whole Quebec group, with its underlying primordial shales, as the greatly developed representatives of the Potsdam and Calciferous groups (with part of that of the Chazy), and the true base of the Silurian system." "The Quebec group with its underlying shales," this author adds (and he expresses the opinion of Sir W. E. Logan), "is no other than the Taconic system of Emmons;" which is thus, by these authors, as well as Mr. James Hall, shown to be the natural base of the Silurian rocks in America, as Barrande and De Verneuil have proved it to be on the continent of Europe.

In our own country a valuable enlargement of our acquaintance with the relations of the primordial zone to the overlying members of the Silurian rocks has been made through the personal examination of Mr. Salter, aided by the independent discoveries of organic remains by MM. Homfray and Ashe, of Tremadoc.

It has thus been ascertained, that the lower member only of the deposit, which has been hitherto merged under the name of Lingula flags, can be considered the equivalent of the primordial zone of Bohemia. In North Wales that zone has hitherto been mainly characterized by Lingula and the crustaceans Olenus and Paradoxides. Certain additions having been made to these fossils, Mr. Slater finds that of the whole there are five genera peculiar to the lower zone, and seven which pass upwards from it into the next overlying band or the Tremadoc slate. But the overlying Tremadoc slate, hitherto also grouped with the Lingula flags, is, through its numerous fossils (many of them of recent discovery), demonstrated to constitute a true lower member of the Llandeilo formation. For, among the trilobites, the well known Llandeilo forms of Asaphus and Ogygia range upwards from the very base of these slates. Again, seven or eight other genera of trilobites, which appear here for the first time, are associated with genera of mollusks, and encrinites which have lived through the whole Silurian series. Such for example are the genera Calymene, Illænus, among crustaceans; the Lingula, Orthis, Bellerophon, Conularia, among mollusks; together with encrinites, corals, and that telling Silurian zoophyte,

* The Silurian classification was proposed by me in 1835, and in the following year, 1836, Dr. Emmons suggested that his black shale rocks, which he called Taconic, were older than any I described.

† Nor are the writings of the Professors W. B. and H. D. Rogers in unison with the opinions of the authors here cited.

the Graptolite. By this proof of the community of fossil types, as well as by a clear lithological passage of the beds, these Tremadoc slates are thus shown to be indissolubly connected with the Llandeilo and other Silurian formations above them; whilst, although they also pass down conformably into the *zone primordiale*, the latter is characterized by the linguloid shells (Lingulella, Salter) and by the genera Olenus, Paradoxides, and Dikelocephalus, which most characterize it in Britain as in other regions.*

I take this opportunity, however, of reiterating the opinion I have expressed in my work, "Siluria," that to whatever extent the primordial zone of Barrande be distinguished by peculiar fossils in any given tract from the prevalent Lower Silurian types, there exists no valid ground for differing from Barrande, de Verneuil, Logan, James Hall, and others, by separating this rudimentary fauna from that of the great Silurian series of life of which stratigraphically it constitutes the conformable base. And if in Europe but few genera be yet found which are common to this lower zone and the Llandeilo formation (though the Agnostus and Orthis are common to it and all the Silurian strata), we may not unreasonably attribute the circumstance to the fact, that the primordial zone of no one country contains more than a very limited number of distinct forms. May we not, therefore, infer that in the sequel other fossil links, similar to those which are now known to connect the Lower and Upper Silurian series—which I myself at one time supposed to be sharply separated by their organic remains—will be brought to light, and will then zoologically connect the primordial zone with the overlying strata into which it graduates? Let us recollect, that a few years only have elapsed since M. de Verneuil was criticised for inserting, in his table of the Palæozoic Fauna of North America, a number of species as being common to the Upper and Lower Silurian. But now the view of the eminent French Academician has been completely sustained, by the discovery in the strata of Anticosti, as worked out by Mr. Billings under the direction of Sir W. E. Logan, of a group of fossils intermediate in character between those of the Hudson River and Clinton formations, or in other words between Lower and Upper Silurian rocks. In like manner, a similar interlacing seems already to have been found, in North America, between the Quebec group, with its primordial fossils, and the Trenton deposits which are, as is well known, of the Llandeilo age.

I have thus spoken out upon the fitness of adhering to the classifications decided upon by Sir Henry De la Beche and his associates, long before I had any relation to the Geological Survey, and which places the whole of the Lingula-flags of Wales as the natural base of the Silurian rocks. For English geologists should remember that this arrangement is not merely the issue of the view I have long maintained, but is also the matured opinion of these geologists in foreign countries and in our colonies, who have not only zealously elaborated the necessary details, but who have also had the opportunities of making the widest comparisons.

* In the last edition of Siluria the distinction was drawn between the lower and upper Lingula-flags, but the fauna of the latter is now much enlarged.

On the continent of Europe, an interesting addition has been made to our acquaintance with the fauna of one of the older beds of the Lower Silurian rocks, or the Obolus green sand of St. Petersburg,* by our eminent associate, Ehrenberg. He has described and figured† four genera and ten species of microscopic Pteropods, one of which he names *Panderella Silurica:* the generic name being in honor of the distinguished Russian palæontologist, Pander, who collected them. It is well to remark, that as the very grains of this Lower Silurian green sand seem to be in great measure made up of these minute organisms, so we recognize, in one of the oldest strata in which animal life has been detected, organisms of the same nature as, and not less abundant than, those which constitute the deep sea bottoms of the existing Mediterranean and other seas.

Before I quit the consideration of the older palæozoic rocks, I must remind you that it is through the discovery, by Mr. C. Peach, of certain fossils of Lower Silurian age in the limestones of Sutherland, combined with the order of the strata, observed in the year 1827, by Professor Sedgwick and myself, that the true age of the largest and overlying masses of the crystalline rocks of the Highlands has been fixed. The fossils of the Sutherland limestone are not indeed strictly those of the Lower Silurian of England and Wales, but are analogous to those of the Calciferous sand-rock of North America. The Macluria is indeed known in the Silurian limestone of the south of Scotland; but the Ophileta and other forms are not found until we reach the horizon of North America. Now, these fossils refer the zone of the Highland limestone and associated quartz-rocks to that portion of the Lower Silurian which forms the natural base of the Trenton series of North America. or the lower part of the Llandeilo formation of Britain. The intermediate formation — the Lingula-flags or "zone primordiale" of Bohemia—having no representative in the north-western Highlands, these is necessarily a complete unconformity between the fossil-bearing crystalline limestones and quartz-rocks with the Maclurea, Murchisonia, Ophileta, Orthis, Otheceratites, &c., and those Cambrian rocks on which they rest.

A great revolution in the ideas of many an old geologist, including myself, has thus been effected. Strengthened and confirmed as my view has been by the concordant testimony of Ramsay, Harkness, Geikie, James, and others, I have had no hesitation in considering a very large portion of the crystalline strata of the Highlands to be of the same age as some of the older fossiliferous Silurian rocks, whether in the form of slates in Wales, of graywacke-schist in the southern counties of Scotland, or in the conditions of mud and sand at St. Petersburg. The conclusions as respects the correlation of all the older rocks of Scotland have now indeed been summed up by Mr. Geikie and myself in the Geological Sketch-Map of Scotland ‡ which we have just published, and a copy of which

* See "Russia and the Ural Mountains."

† Monats-Bericht d. König. Akad. der Wisa. Berlin, 18th April, 1861.

‡ This map is already on sale in Manchester.

is now exhibited. Not the least interesting part of that production is that which explains the age of all the igneous or trappean rocks of the south of Scotland, as well as all the divisions of the Carboniferous formation, and is exclusively the work of my able colleague.

But if through the labors of hard working geologists, we have arrived at a clear idea of the first recognizable traces of life and their sequences, we are yet far from having satisfied our minds as to the *modus operandi* by which whole regions of such deposites have, as in the Highlands, been transmuted into a crystalline slate. Let us therefore hope that, ere this meeting closes, we may receive instructions from some one of the band of foreign or British geologists who have by their experimental researches been endeavouring to explain the processes by which such wonderful changes in the former condition of sedimentary deposits have been brought to life: such as that by which strata once resembling the incoherent Silurian clay which we see in Russia have been hardened into such rocks as the slaty grauwacke of other regions, and now hard schists of the south of Scotland have been metamorphosed into the crystalline rocks of the Highlands. But why are British geologists to see any difficulty in admitting what I have proposed, that vast breadths of these crystalline stratified rocks of the Highlands are of Lower Silurian age? Many years ago I suggested, after examination, that some of the crystalline rocks near Christiana in Norway were but altered extensions of the Silurian deposits of that region; and since then Mr. David Forbes and Mr. Kjerulf have demonstrated the truth of the suggestion. Again, and on a vastly larger scale, we know that in North America all the noted geologists, however they may differ on certain details, agree in recognizing the fact that the vast eastern seaboard range of gneissic and micaceous schists is made up of metamorphosed strata, superior even to the lowest of the Silurian rocks. Logan, Rogers, Hall, and Sterry Hunt, are decidedly of this opinion; and the point has been most ably and clearly set before the public by the last mentioned of these geologists, who, being himself an accomplished chemist, has given us some good illustrations of the probable *modus operandi* in the bringing about of these changes.

The importance of the inquiries to be made by chemical geologists into this branch of our science was not lost upon the earlier members of the British Association. Even in the year 1833, a committee was appointed to endeavour to illustrate the phenomena of the metamorphism of rocks by experiments carried on in iron-furnaces. After a series of trials on various mineral substances, the Rev. W. Vernon Harcourt, to whom we owed so much at our foundation, has, as the reporter of that committee, been enabled to present to the Association that lucid report on the actual effect of long-continued heat which is published in our last volume. In referring you to that document, I must, as an old practical field-geologist, express the gratification I feel in seeing that my eminent friend has, in the spirit of true inductive philosophy, arrived, after much experiment and thought, at the same conclusion at which, in common with Sedgwick, Buckland, De la Beche, Phillips, and others in my own country, and with L. Von Buch, Elie de Beaumont, and a host of geologists abroad, I had long ago arrived in the field. I, therefore, reëcho their voices in repeating the words of Mr. W. Harcourt, "that we are not entitled to presume that the forces which have operated on the earth's crust have always been the same." Looking to the only rational theory which has ever been propounded to account for the great changes in the crust which have taken place in former periods—the existence of an intense central heat which has been secularly more and more repressed by the accumulation of sediment until the surface of the planet was brought into its present comparatively quiescent condition—our first General Secretary has indicated the train of causes, chemical and physical, which resolve some of the difficulties of the problem. He has brought before us, in a compendious digest, the history of the progress which has been made in this branch of our science, by the writings of La Place, Fourier, Von Buch, Fournet, and others; as well as by the experimental researches of Mitscherlich, Berthier, Senarmont, Loubree, Deville, Delesse and Durocher. Illustrating his views by reference to chemical changes in the rocks and minerals of our own country, and fortifying his induction by an appeal to his experiments, he arrives at the conclusion, that there existed in former periods a much greater intensity of causation than that which now prevails. His theory is, that whereas now, in the formation of beds, the aqueous action predominates, and the igneous is only represented by a few solfataras, in the most ancient times the action was much more igneous, and that in the intermediate times fire and water divided the empire between them. In a word, he concludes with the expression of the opinion, which my long-continued observation of facts had led me to adopt, "that the nature, force and progress of the past condition of the earth cannot be *measured* by its existing condition."

In addition to these observations on metamorphism, let me remind you that, on the recommendation of the British Association, other important researches have been carried on by Mr. William Hopkins, our new General Secretary, and in the furnaces of our President, Mr. Fairbairn, on the conductive powers for heat in various mineral substances. Although these experiments have been retarded by a serious accident which befel Mr. Hopkins, they are still in progress, and I learn from him that, without entering into any general discussion as to the probable thickness of the crust of our planet, we may even now affirm, on experimental evidence, that, assuming the observed terrestrial temperature to be due to central heat, the thickness of this crust must be two or three times as great as that which has been usually considered to be indicated by the observed increase of temperature at accessible depths beneath the earth's surface.

Of the Devonian rocks, or Old Red Sandstone, much might be said if I were to advert to the details which have been recently worked out in Scotland, by Page, Anderson, Mitchel, Powrie and others; and in England, by the researches of the Rev. W. Symonds, and other members of the Woolhope and Malvern Clubs. But confining myself to general observations, it may be stated, that a triple subdivision of that group, which I have shown to hold good over the continent of Europe

as in our own country, seems now to be generally admitted, whilst the history of its southern fauna in Devonshire has recently been graphically and ably elaborated by Mr. Pengelly, in a paper printed in our last volume.

In Herefordshire and Shropshire the passage of the upper members of the Silurian rocks into the inferior strata of the Old Red group, has been well shown by Mr. Lightbody, and the fossils of its lower members have been vigorously collected. Whilst in Scotland, Mr. Geikie and others have shown the upward passage of *its superior* strata into the base of the Carboniferous rocks; and Dr. Anderson announces the finding of shells with crustacea in the lower or grey beds, south of the Tay. I may here note, that the point which I have been for some years endeavouring to establish as to the true position of the Caithness flags with their numerous ichthyolites seems to be admitted by my contemporaries. The lamented Hugh Miller considered these ichthyolites as belonging to the lower member of the group, and had good grounds for his views, since at his native place, Cromarty, these fish-beds appear very near the base. But by following them into Caithness and the Orkneys, I have shown that they occupy a middle position, whilst the true base of the group is the equivalent of the zone with Cephalaspis, Pteraspis, and Pterygotus.

And here it is right to state, that the upper Silurian rocks which are clearly represented in Edinburghshire, and which in Lanarkshire seem to graduate upwards into the Lower Old Red or Cephalaspis sandstone, are wanting in the Highlands; thus accounting for the great break which there occurs between the crystallized rocks of Lower Silurian age and the bottom beds of the Old Red Sandstone.

Of the Old Red Sandstone of Scotland and Herefordshire I may be permitted further to observe, that its downward passage into the uppermost Silurian rock, and the upward passage of its higher strata into the Carboniferous strata has been well developed, the one near Ludlow, chiefly through the labours of Mr. Lightbody; the other in Scotland, through the researches of the Government Geologists, Howell and Geikie, as well as by those of Mr. D. Page and other observers. On this head I may, however, note, what my contemporaries now seem to admit, that the removal of the Caithness flags and their numerous included ichthyolites from the bottom of this group, and their translation to the central part of the system, as first proposed by myself, is correct. In truth the lower member of this system is now unequivocally proved to be the band with Cephalaspis, Pteraspis, &c., as seen in Scotland, England, and Russia. The great break which has been traced in the south of Scotland by Mr. Geikie between the lower and upper Old Red is thus in perfect harmony with the zoological fact that the central or Caithness fauna is entirely wanting in that region, as in England—as it is indeed in Ireland, where a similar break occurs.

It gratifies me to add that many new forms of those fossil fishes which so peculiarly characterize the Old Red Sandstones have been admirably described by Sir Philip de Grey Egerton in the Memoirs of the Geological Survey; and I must remark that it is most fortunate that the eminent Agassiz is here so well represented by my distinguished friend, who stands unquestionably at the head of the fossil ichthyologists of our country.

Very considerable advances have been made in the development of our acquaintance with that system—the Carboniferous—which in the north of England (Yorkshire) has been so well described by Professor Phillips, and with which all practical geologists in and around Manchester are necessarily most interested. The close researches of Mr. Binney, who has, from time to time, thrown new lights on the origin and relations of coal, and the componant part of its matrix, established proofs, so long ago as 1840, that great part of our coal fields was accumulated under marine conditions; the fossils associated with the coal-beds being, not as had been too generally supposed, of fluviatile or lacustrine character, but the spoils of marine life. Professor Henry D. Rogers came to the same conclusion with regard to the Apalachian coalfields in America, in 1842 Mr. Binney believes that the plant Sigillaria grew in salt water, and it is to be remarked that even in the so-called "fresh water limestones" of Ardwick and Le Botwood the Spirorbis and other marine shells are frequent, whilst many of the shells termed Cypris may prove to be species of Cytherea. Again, in the illustrations of the fossils which occur in the bands of iron-ore in the South Welch coalfield, Mr. Salter, entering particularly into this question, has shown that in the so-called "Unio-beds" there constantly occurs a shell related to the Mya of our coasts, which he terms Anthracomya; whilst, as he has stated in the "Memoirs of the Geological Survey," just issued, the very Unios of these beds have a peculiar aspect, differing much from that of true fresh-water forms. They have, he says, a strongly wrinkled epidermis, which is a mark of the Myadæ, or such burrowing bivalve shells, and not of true Unionidæ; they also differ in the interior, as shown by Professor W. King. Seeing that in these cases quietly deposited limestones with marine shells (some of them indeed of estuary character) rest upon beds of coal, and that in many other cases purely marine limestones alternate frequently with layers of vegetable matter and coal, and may we not be led to modify the theory, founded on the sound observation of Sir W. E. Logan, by which the formation of coal has been rather too exclusively referred to terrestrial and fresh-water conditions? May we not rather revert to that more expansive doctrine, which I have long supported, that different operations of nature have brought about the consolidation and alteration of vegetable matter into coal? In other words, that in one tract the coal has been formed by the subsidence *in situ* of vast breadths of former jungles and forests; in another, by the transport of vegetable materials into marine estuaries; in a third case, as in Russia and Scotland (where purely marine limestones alternate with coal), by a succession of oscillations between jungles and the sea; and lastly, by the extensive growth of large plants in shallow seas.

The geological map of Edinburghshire, prepared by Messrs. Howell and Geikie, and recently published, with its lucid explanations, affords indeed the clearest proofs of the frequent alternations of beds of purely marine limestone charged with Producti and bands of coal, and is in direct ana-

logy with the coalfields of Donetz, in Southern Russia.*

In sinking through the extensive coal tracts around Manchester (at Dukinfield), where one of the shafts already exceeds in depth the deepest of the Durham mines, rigorous attention will, I hope, be paid to the discovery of the fossils which characterize each bed passed through, not merely to bring about a correctly matured view of the whole history of these interesting accumulations, formed when the surface of our planet was first furnished with abundant vegetation, but also for the practical advantage of the proprietor and miner, who, in certain limited areas, may thus learn where iron-ores and beds of coal are most likely to be persistent. In carrying out his survey-work through the northwestern coal-tracts of Lancashire, to which the large, or six-inch, Ordnance-map has been applied, one of the Secretaries of this Section, Mr. Hull, has done good service in accurately defining the tracts wherein the elevated coal-deposits are covered with drift only, in contradistinction to those which are still surmounted by red rocks of Permian and Triassic age. In seeing that these are eagerly bought by the public, and in recognizing the great use which the six-inch survey has proved in the hands of the geological surveyors in Scotland, our friends in and around Manchester may be led to insist on having that large scale of survey extended to their own important district. By referring to the detailed delineations of the outcrops of all the Carboniferous strata in the counties of Edinburgh, Haddington, Fife, and Linlithgow, as noted by Professor Ramsay and Messrs. Howell and Geikie, the coal-proprietors of England will doubtless recognize the great value of such determinations.

Concerning the Permian Rocks, which were formed towards the close of the long palæozoic era, and constitute a natural sequel to the old Carboniferous deposits, it is to be hoped that we shall here receive apposite illustrations from some of our associates.

When Professor Sedgwick, thirty-four years ago, gave to geologists his excellent Memoir on the Magnesian Limestone of our country, as it ranges from Durham, through Yorkshire, into Nottinghamshire, he not only described the numerous varieties of mineral structure which that rock exhibits, noting at the same time its characteristic fossils, but he also correlated it, and its underlying beds, with the Zechstein, Kupferschiefer, and Rothetodte-liegende, of Germany. But whilst this is the true order in both countries, there is this considerable difference in England, that along the zone where the Magnesian Limestone exists as a mass, and where Sedgwick described it, the inferior member of the group is a thin band of sandstone, usually of a yellow colour (the Ponterfact rock of William Smith), which in its southern extremity, near Nottingham, is almost evanescent. In many parts of Germany, on the contrary, and notably in Thuringia and Silesia, the same lower band, with a few intercalated courses of lime-stone, swells out into enormous thicknesses and even constitutes lofty ridges.

In Russia the series of this age puts on very different mineral arrangement. There the calcareous bands, containing the very same species of shells as the magnesian limestone of Germany and Britain, are intercalated with pebble-beds, sandstones, marls, and copper-ores, so that, although the same lithological order does not prevail as in the Saxon or typical Permian country of the elder German geologists, the group is, through its fossil types, unquestionably the same. It was from the observation of this fact, and from seeing that these deposits, so mixed up, yet so clearly correlated by their animal and vegetable relics, and all superposed to the Carboniferous system, occupied a region twice as large as the British Isles, in which the varieties of structure are best seen, in the government of Perm, that I proposed in 1841, that the *whole group* should have the name of "Permian."

Of late years various British authors, including King, Howse, and others, have ably described the fossil shells of this deposit as it exists on the eastern side of the Penine chain; and recently Mr. Kirkby has produced a carefully-written and well-considered memoir, showing the relations of the whole group by comparing its structure and palæontological contents in Durham with those in South Yorkshire. Whilst, in addition, my associates of the Geological Survey, particularly Mr. Aveline, have been carefully delineating the area of these beds in their northern range from Nottingham through Yorkshire, much yet remains to be done in correlating the Permian rocks lying to the west of the Penine ridge, or where we are now assembled, with their eastern equivalents.

Already, however, great strides have been made towards this desirable end. Thus, Mr. Binney has indicated the succession in the neighbourhood of Manchester, and has shown us that there some of the characteristic fossils of the eastern magnesian limestone, exist in red marl and limestones subordinate thereto, and that these are clearly underlaid by other red sandstones, shales, and limestones, which he terms Lower Permian. He has further followed these Lower Permian beds to the west and northwest, and finds them expanding into considerable thicknesses at Astley, Scarrisbrick, and other places where they overlie the coal measures, and he has also traced them into Westmoreland, Cumberland and Dumfrieshire. In the last case he went far to prove that which I suggested many years ago, that the red sandstones of Dumfriesshire containing the large footprints of chelonians, as described by Sir W. Jardine, are of Lower Permian age.

This view of the relations of the Permian rocks of the northwest has been also taken by Professor Harkness, and this summer he has successfully worked out, and has definitely applied the Permian classification to large tracts in Cumberland, as explained in a letter to myself. He finds that the breccias and sandstones of Kirby-Stephen and Appleby, which at the latter place have a thickness of three thousand feet, extend northward on the west side of the Eden (the breccia being replaced by false-bedded sandstones with footprints), and attain near Carlisle the enormous thickness of about five thousand feet. These beds he classes unhesitatingly as Lower Permian, because he finds them to be overlaid (near Ormside) by a group of

* See Russia in Europe and the Ural Mountains, Vol. 1.

clays, sandstones, and magnesian limestones, containing peculiar plant remains and shells of the genus Schizodus, representing in his opinion the marlslate and magnesian limestone of Durham. These again support beds equivalent to the Zechstein, and the last are covered by the Triassic sandstone of the Solway.

A very striking fact, noticed by Professor Harkness, and corroborative of earlier researches made by Mr. Binney, is the existence of footprints, in the Lower Permian of Cumberland, similar to those of Corncockle Moor, in Dumfriesshire, where, from my own observations, including those of last year, these Lower Permian sandstones have, I am convinced, a greater thickness even than that which is assigned to them in Cumberland.

Notwithstanding these discoveries, we have still to show the continuous existence of the Lower Red Sandstone of Shropshire, Worcestershire, and Staffordshire, which I have classed as the lower member of the Permian rocks, and to decide whether it be really such lower member *only*, or is to be regarded as the equivalent of the whole Permian group, under different mineral conditions. With the extension of the Geological Survey this point will, doubtless, be satisfactorily adjusted, and we shall then know to what part of the series we are to attach the plant-bearing red beds of Coventry and Warwick, described as Permian by Ramsay and his associates. We have also to show that, in its northern course, the lower red sandstone of the central counties, with its calcareous conglomerates, graduates into the succession exhibited at Manchester, thence expanding northwards. Already, however, we have learned that in our own little England, which contains excellent normal as well as variable types of all palæozoic deposits, there exists proofs that the Permian rocks, according to the original definition of the same, present to the observer, who examines them to the west as well as to the east of the Penine chain, nearly as great diversities of lithological structure, in this short distance, as those which distinguish the strata of the same age in Eastern Russia in Europe from the original types of the group in Saxony and other parts of Germany.

(*To be continued.*)

ILLUMINATING GAS.

The price at which illuminating gas can be made and distributed is a very important question, particularly in those places where new works have been projected, and the future consumers are altogether unused to any mode of illumination than that furnished by the old-fashioned lamps and candles. In fixing upon a rate at which gas is to be sold, comparisons are instituted between the price ruling in localities somewhat similarly situated, and the question is often settled by adventitious circumstances, which, but for some unforseen occurrence, would have been decided in a manner more beneficial to both shareholders and consumers. It cannot be questioned that frequently a grasping spirit is exhibited by new gas companies, which sound judgment cannot but condemn. A too eager desire is manifested by shareholders to reap quick returns in the shape of dividends, and the ultimate prosperity of the company, as enhanced by lower prices and an increasing number of consumers, is too often lost sight of. This state of things is more liable to occur in small towns, where the people have been long accustomed to practice the severest economy, and who cling to former habits with great tenacity. Many instances of this nature have been observed in the history of British gas-light companies, in some of which prices have been kept up, while the addition of consumers has been very slow. On the contrary, in other companies, where a more liberal spirit has been manifested, and a future increase of business rather than present profit has been sought, a permanent degree of prosperity has been attained, far distancing some of the companies who pursued a different course. Our table of American Gas-Light Companies, published on pages 198 and 199 of this volume, furnish a statement of the price charged by the various companies, and other statistics of value. From these tables it will be seen that the price of gas, in the United States, varies all the way from $1.50 to $12.50 per thousand cubic feet. For the purpose of reviewing the average cost of gas to consumers, we have classified the figures charged in the various localities, and are thus enabled to present them in a more intelligible shape than when arranged merely in alphabetical order. There are, altogether 420 gas-light companies in the United States, of which 354 manufacture coal-gas, 30 rosin-gas, 1 wood-gas, and 3 water-gas. Of the coal-gas companies, our tables give the rates charged by 380 of them. Beginning at the companies whose product is sold at the lowest rate, the Brooklyn, N. Y., and Pittsburgh, Pa., gas-light companies, head the column—they disposing of their product at the remarkably low figure of $1.50 per thousand cubic feet. The Marysville, Cal., Gas-Light Company brings up the rear, with the exorbitant price of $12.50 per thousand cubic feet.

There are

2	Companies	charging	per	1,000 c. f.......	$1 50
2	"	"	"	"	2 00
3	"	"	"	"	2 25
9	"	"	"	"	2 50
1	"	"	"	"	2 70
1	"	"	"	"	2 90
32	"	"	"	"	3 00
1	"	"	"	"	3 10
1	"	"	"	"	3 20
1	"	"	"	"	3 24
4	"	"	"	"	3 25
62	"	"	"	"	3 50
10	"	"	"	"	3 60
1	"	"	"	"	3 62
2	"	"	"	"	3 70
3	"	"	"	"	3 75
9	"	"	"	"	3 80
1	"	"	"	"	3 86
172	"	"	"	"	4 00
1	"	"	"	"	4 40
18	"	"	"	"	4 50
19	"	"	"	"	5 00
1	"	"	"	"	5 40
11	"	"	"	"	6 00
1	"	"	"	"	6 70
2	"	"	"	"	7 00
2	"	"	"	"	8 00
7	"	"	"	"	10 00
1	"	"	"	"	12 50

The average price of coal-gas in the United States, as computed from the above figures, is within a fraction of $4.06 per thousand cubic feet. In this calculation the prices of the California gas-light companies are included, which are much higher than those charged in any of the older States, owing to a variety of circumstances, and the proportional expenses of other necessaries of living.

In view of the price of gas which obtains in other countries, this average must be considered as high —too high for the mutual benefit of producers and consumers—especially when kerosene oil presents so many claims upon the attention of the public as an economical illuminating agent. Notwithstanding the danger attending the promiscuous use of some descriptions of this oil, and which is almost the only drawback to its adoption, it is used to an enormous extent, and has doubtless retarded the construction of gas-works in many places—particularly in the Western States. The cheapness of kerosene oil is easily demonstrated, and light for light, it runs a successful competition with gas, assuming the average price of the latter article as a standard. Gas engineers would do well to look this matter in the face, and act accordingly. The fact may be unpleasant to contemplate, but it is nevertheless patent to all who will take the trouble to examine it.

We have always opposed senseless agitations respecting reductions in the price of gas, and on page 248 exhibited the fallacy of the arguments generally adopted by such agitators. But while condemning such diatribes as are usually fulminated on this subject, we deem it a matter worthy of mature reflection whether the general interests of shareholders would not be better served, and a large additional consumption attained, by gradual and prudent concessions. At any rate, a perusal of statistics like the above may be suggestive, and we commend the subject to the consideration of the profession generally.

In consequence of the recent reports of Dr. Letheby and Mr. Haywood to the City Commission of Sewers, in London, recommending the extra carburation of gas supplied to the city lamps, attention has been drawn to the subject, and already plans for effecting the napthalization have been submitted both in this country and in England. On page 133 of this volume we gave an illustration of Gwynne's gas carbonizer, which is said to perform its work with great satisfaction, accomplishing a saving in gas bills which must commend it to consumers generally. Other modifications of apparatus for this purpose have been brought before the public, and it remains to be seen whether their adoption will become general.

The idea of increasing the illuminating power of gas, by saturating it with the vapor of a volatile hydrocarbon, was first suggested by Mr. Lowe, who, many years ago, proposed to pass gas through naphtha. The prospect of so largely reducing the amounts of gas bills by this expedient, which seemed imminent, was not by any means pleasing to the gas companies, who opposed the innovation with considerable energy. In consequence of this opposition, very few consumers adopted the suggestion, the companies being successful in the resistance which they interposed. In addition to the antagonism offered by the gas companies, insurance companies likewise placed obstacles in the way of the new invention, under the plea that an inflammable substance, such as naphtha, would render their risks more hazardous. The futility of this reason must be apparent to all; and the fact that many more inflammable substances are in daily use in many households, with no remonstrance being urged against them, suggests the idea that some undue influence must have been brought to bear upon the insurance companies, or that the dangerous nature of naphtha must have been described to them with a too generous use of depreciatory adjectives. Mr. Lowe's original idea was to fill an ordinary wet meter with naphtha, so that the gas might be measured and rendered more luminous at the same time. This plan proving objectionable, a box containing a number of shelves, and separated into partitions, was substituted for it. The naphtha was either poured upon the shelves in small quantities at a time, or sponges or cloths, saturated with the liquid, were placed upon them. The gas was made to traverse over and around the hydrocarbon, and was thus rendered highly luminous.

One of the great advantages claimed for naphthalized gas, in addition to that of economy, is that much less heat is generated than when gas alone is used. Those who are familiar with the subject, and who have experimented upon both methods of burning gas, say that light for light, the heating power of naphthalized gas is to that of ordinary gas in the ratio of three to four. In summing up the recommendations of naphthalized gas, Knapp says that its light is more analagous to that of the sun, and that objects illuminated by it, particularly the face, assume a much more natural appearance, and do not partake of the pallid hue which is peculiar to all objects illuminated by ordinary coal-gas.

It is stated by correspondents of the daily newspapers, that some sweeping reforms are about being inaugurated by the New York Legislature, now in session at Albany. Among the offices which rumour states are to be abolished, is that of the inspector of gas-meters. If this be true, it is an unfortunate movement, to say the least of it. We have repeatedly referred to the importance of this office, and to the able manner in which the present incumbent fulfils his duties. We trust the rumour in question may prove premature, and hope that the good sense of the members of the Legislature may induce them to see that a real wrong would be perpetrated by the repeal of the act establishing the office.—*American Gas-Light Journal.*

The Great Mont Cenis Works.

M. Sommeiller, who is the director of the great works connected with the perforation of Mont Cenis, in a letter, states that everything is proceeding satisfactorily. Hitherto the boring has been carried on at the south end, but in Jonuary or February vast machines will be set to work on the north side also. Progress is now being made at the rate of about seven feet a day, and this speed will be doubled by February; but it will take at least six years more to accomplish this extraordinary and almost super-human task.

Board of Arts and Manufactures FOR UPPER CANADA.

THE LIBRARY OF REFERENCE.

At the monthly meeting of the Committee, held on the 27th ultimo, it was

Resolved, on motion of Mr. Sheppard, "That the Library of the Board be opened to the public (for reference) on the evenings of Tuesday and Friday of each week, from 7 to 10 o'clock;" in addition to the usual hours, from 10 A. M. to 4 o'clock, P. M., daily.

The Library contains several hundred volumes of valuable books of reference in architecture, decoration and ornament, designing, encyclopœdias, engineering and mechanics, manufactures and trades, general science, patents of inventions of Great Britain, the United States and Canada, &c.

W. EDWARDS, *Secretary*.

DRAFT OF A MEMORIAL OF THE BOARD OF ARTS AND MANUFACTURES FOR UPPER CANADA RELATING TO A RENEWAL OF AN ANNUAL GRANT TO MECHANICS' INSTITUTES THROUGHOUT THE PROVINCE.

To the Honourable the Legislative Assembly of Canada, in Provincial Parliament assembled.

The Board of Arts and Manufactures for Upper Canada, respectfully beg leave to represent to your Honourable House, that during the session of the Provincial Parliament in the year 1859, as soon as it was publicly known that it was the intention of the Government to withdraw all grants to Mechanics' Institutes, a deputation was appointed by the committee of this Board to wait upon the Hon. Finance Minister, and to represent the effect of the withdrawal of Government support, not only on the different Mechanics' Institutes throughout the Province, but also on this Board.

The Finance Minister then assured the deputation that it was the intention of the Government to resume the annual grants to Mechanics' Institutes in the following year, under a new and more judicious mode of distribution.

The period for the renewal of these grants having now been deferred for three years, the Board of Arts and Manufactures for Upper Canada respectfully approach your Honourable House with the prayer that the support of the Government may no longer be withheld from the Mechanics' Institutes in existence, or which may be formed, throughout the Province; and with a view to ensure the judicions application of a Government grant, the Board respectfully suggest that the following scheme of its disbursement be adopted and authorized:

1st, A renewal of the grant of $200 per annum to be made to each properly organized Mechanics' Institute throughout the Province, embracing not less than fifty members, paying at least $1 per annum, and twenty of whom shall be working mechanics or manufacturers.

2nd. Fifty per cent. of the grant, or $100, to be appropriated to the purchase of books of an instructive character for manufacturers and artizans; such works to be supplied through the Board of Arts and Manufactures at reduced rates; but the selection from an approved list, to be made by the Institutes themselves.

3rd. Forty per cent. or $80, to be devoted to the encouragement of classes established in the respective Institutes, for class instruction in mechanical or natural sciences by lectures or otherwise; and for prizes to be given to successful competition at the Annual Examination of member of Mechanics' Institutes, established by this Board.

4th. Ten per cent., or $20, to be retained by the Board of Arts and Manufactures for prizes in the Arts and Manufactures Departments of the Provincial Exhibition.

5th. The distribution of the annual grants for Upper Canada to be made by this Board, upon approved returns from each Institute of the proper application of the funds applied for and expended in the formation and instruction of classes, or in the establishment of prizes, such returns to be forwarded by this Board to the Auditor General at the close of each year, with a report on the working of the respective Institutes.

6th. Any funds not legally claimed by the Institutes, to be set apart for the engagement of occasional lectures on subjects relating to arts and manufactures, selected by the respective Boards, and for the publication of such lectures with appropriate illustrations in the journals of the respective Boards.

Your memorialists deem it highly desirable to supply the manufacturers and artizans of Canada with easy facilities for obtaining the best information relating to the several branches of industry, and would therefore, to that end, respectfully beg leave to urge upon your Honourable House, the vast importance of renewing the annual grants to Mechanics' Institutes; believing that the means your memorialists venture to suggest are well adapted to carry out the desirable object.

Wherefore your memorialists humbly pray, that your Honourable House will be pleased to recommend to His Excellency the Governor General, that the annual grants to Mechanics' Institutes may be resumed, upon the scheme of distribution hereinbefore suggested, or upon such other plan as to your Honourable House may seem best: and your memorialists as in duty bound will ever pray, &c., &c.

PROVINCIAL EXHIBITION.

Local Committee for 1862.

Hon. G. W. ALLAN, Pres. Horticu. Soc., *Chairman.*
J. G. BOWES, Esq., Mayor of Toronto.
J. P. WHEELER, Esq., Warden of County.
F. W. JARVIS, Esq., Sheriff of County.
RICE LEWIS, Esq., Presid. Toronto Mechanics' Inst.
JAS. BEACHELL, Esq., President Toronto Electoral Division Society.
Prof. HIND, Trinity College University.
Prof. CROFT, University College.
ALEXANDER SHAW, Esq.
JOHN P. BULL, Esq.
ARCHIBALD BARKER, Esq.
Aldermen BRUNEL, CARR, HYNES and STRACHAN.
The Members of the Board of Agriculture, as Council of the Association, *ex-officio.*
W. EDWARDS, *Secrerary* and *Treasurer.*

The Committee has adopted plans for permanent stables for 198 horses, sheds for 435 heads of cattle, and a machine and carriage shed 272 feet long by 32 feet wide.

At a meeting of the Committee on the 5th inst., tenders were accepted for the construction of the horse stables and machine and carriage shed, at a cost of $4,840.

The acceptance of the tenders for the erection of he cattle sheds is postponed until the committee is assured of having sufficient funds to meet the expense of permanent buildings.

The prize list for the Arts and Manufactures Department of the Exhibition, in which great improvements have been made on former years, appears in the present number of this *Journal.*

PROVINCIAL EXHIBITION.

PRIZE LIST—ARTS AND MANUFACTURES DEPARTMENT.

The following is the Prize List of the Arts and Manufactures Department of the Agricultural Association's Exhibition, to be held in the City of Toronto, on September 30th, and October 1st, 2nd and 3rd, 1862. The whole of the Rules and Regulations will be published in the next issue.

CLASSIFICATION OF PRIZE LIST.

ARTS, MANUFACTURES, LADIES' WORK, &c., &c.

Class 38—Cabinet Ware and other Wood Manufactures.
" 39—Carriages and Sleighs, and parts thereof.
" 40—Chemical Manufactures and Preparations.
" 41—Decorative and Useful Arts; Drawings and Designs.
" 42—Fine Arts.
" 43—Groceries and Provisions.
" 44—Ladies' Work.
" 45—Machinery, Castings, and Tools.
" 46—Metal Work (Miscellaneous) including Stoves.
Class 47—Miscellaneous, including Pottery, and Indian Work.
" 48—Musical Instruments.
" 49—Natural History.
" 50—Paper, Printing, and Bookbinding.
" 51—Saddle, Engine Hose, and Trunkmaker's Work; and Leather.
" 52—Shoe and Bootmakers' Work; and Leather.
" 53—Woollen, Flax, and Cotton Goods; and Furs and Wearing Apparel.
" 54—Foreign Manufactures.

Class 38—Cabinet Ware, and other Wood Manufactures.

Cabinet Ware.

Sect.		1st Prize.	2nd Prize.
1	Bed Room Furniture, set of	$10 00	$8 00
2	Centre Table	7 00	5 00
3	Drawing Room Sofa	7 00	5 00
4	Drawing Room Chairs, set of	7 00	5 00
5	Dining Room Furniture, set of	8 00	6 00
6	Side Board	6 00	4 00
7	Wardrobe	5 00	4 00

Miscellaneous.

Sect.		1st Prize.	2nd Prize.
8	Cooper's Work	4 00	3 00
9	Curled Hair, 10 lbs	3 00	2 00
10	Handles for Tools for carpenters, blacksmiths, gunsmiths, watchmakers, &c , &c., collection of	8 00	5 00
11	Joiner's Work, assortment of	8 00	5 00
12	Machine-wrought Moulding, and Flooring, 100 feet of each	6 00	4 00
13	Turning in Wood, collection of specimens	6 00	4 00
14	Veneers from Canadian Woods	10 00	6 00
15	Wash-tubs and Wooden Pails, three of each, factory made	4 00	3 00
16	Willow Ware, six specimens	4 00	3 00
17	Extra entries		

Class 39—Carriages and Sleighs, and Parts thereof.

Sect.		1st Prize.	2nd Prize.
1	Axle, wrought iron	$3 00	$2 00
2	Bent Shafts, half a dozen	3 00	2 00
3	Buggy, double seated	8 00	6 00
4	Buggy, single seated	7 00	5 00
5	Carriage, two-horse, pleasure	12 00	8 00
6	Carriage, one-horse, pleasure	8 00	6 00
7	Child's Carriage	4 00	3 00
8	Dog Cart, single horse	6 00	4 00
9	Hubs, two pairs of carriage	3 00	2 00
10	Rims or Felloes, two pairs of carriage	3 00	2 00
11	Spokes, one dozen machine made carriage	3 00	2 00
12	Sleigh, two-horse, pleasure	10 00	7 00
13	Sleigh, one-horse, pleasure	8 00	6 00
14	Springs, one set of steel carriage	4 00	3 00
15	Wheels, one pair of carriage (unpainted)	4 00	3 00
16	Extras		

Class 40—Chemical Manufactures and Preparations.

Sect.		1st Prize.	2nd Prize.
1	Essential Oils, assortment of	$6 00	$4 00
2	Glue, 14 lbs.	3 00	2 00
3	Isinglass, 1 lb.	3 00	2 00
4	Medicinal Herbs, Roots and Plants, native growth	12 00	8 00
5	Oils, Linseed and Rape, and other expressed kinds	6 00	4 00
6	Oil, Coal, Shale or Rock	6 00	4 00
7	Varnishes, assortment of	6 00	4 00
8	Extra entries		

Class 41—Decorative and Useful Arts, Drawings and Designs.

Sect.		1st Prize.	2nd Prize.
1	Architectural Design, with complete detail Drawings	$12 00	$8 00
2	Carving in Wood	6 00	4 00
3	Drawing of Machinery, in perspective	5 00	3 00
4	Decorative House Painting	5 00	3 00
5	Engraving on Wood, with proof	5 00	3 00
6	Engraving on Copper, with proof	5 00	3 00
7	Goldsmith's Work	5 00	3 00
8	Geometrical Drawing of Engine or Millwright work, coloured	5 00	3 00
9	Lithographic Drawing	5 00	3 00
10	Lithographic Drawing, coloured	6 00	4 00
11	Mantlepiece in marble	10 00	6 00
12	Mathematical, Philosophical and Surveyor's Instruments, collection of	15 00	10 00
13	Modelling in Plaster	6 00	4 00
14	Monumental Tomb or Headstone	6 00	4 00
15	Picture Frame, ornamented gilt	5 00	3 00
16	Seal Engraving, with wax impressions	6 00	4 00
17	Silversmith's Work	5 00	3 00
18	Stained Glass, collection of specimens	10 00	6 00
19	Extra entries		

Class 42—Fine Arts.

Professional List—Oil.

Sect.		1st Prize.	2nd Prize.
1	Animals, grouped or single	$12 00	$8 00
2	Historical Painting	12 00	8 00
3	Landscape, Canadian Subject	12 00	8 00
4	Marine Painting, Canadian Subject	12 00	8 00
5	Portrait	10 00	7 00
	In Water Colours.		
6	Animals, grouped or single	8 00	6 00
7	Flowers, grouped or single	8 00	6 00
8	Landscape, Canadian subject	8 00	6 00
9	Marine View, Canadian subject	8 00	6 00
	Pencil, Crayon, &c.		
10	Crayon, coloured	6 00	4 00
11	Crayon, plain	6 00	4 00
12	Pencil Drawing	6 00	4 00
13	Pen and Ink Sketch	6 00	4 00

Amateur List—Oil.

		1st Prize.	2nd Prize.
14	Animals, grouped or single	9 00	7 00
15	Historical Painting	9 00	7 00
16	Landscape, Canadian subject	9 00	7 00
17	Marine Painting, Canadian subject	9 00	7 00
18	Portrait	8 00	6 00
	In Water Cotours.		
19	Animals, grouped or single	8 00	6 00
20	Flowers, grouped or single	5 00	3 00
21	Landscape, Canadian subject	8 00	6 00
22	Marine View, Canadian subject	8 00	6 00
	Pencil, Crayon, &c.		
23	Crayon, coloured	5 00	3 00
24	Crayon, plain	5 00	3 00
25	Pencil Drawing	5 00	3 00
26	Pen and Ink Sketch	5 00	3 00
	Photography.		
27	Ambrotypes, collection of	7 00	6 00
28	Photograph Portraits, collection of, in duplicate, one set coloured	10 00	8 00
29	Photograph Portraits, collection of, plain	8 00	6 00
30	Photograph Landscapes and Views, collection of	9 00	7 00
31	Photograph Portraits in oil	8 00	6 00
32	Extras		

Class 43—Groceries and Provisions.

Sect.		1st Prize.	2nd Prize.
1	Barley, Pearl	$3 00	$2 00
2	Barley, Pot	3 00	2 00
3	Bottled Fruits, an assortment, manufactured for sale	6 00	4 00
4	Bottled Pickles, an assortment, manufactured for sale	6 00	4 00
5	Buckwheat Flour	3 00	2 00
6	Cayenne Pepper, from Capsicums grown in the Province	2 00	1 00
7	Chickory, 20 lbs. of	3 00	2 00
8	Indian Corn Meal	3 00	2 00
9	Oatmeal	3 00	2 00
10	Sauces for table use, an assortment, manufactured for sale	6 00	4 00
11	Soaps, collection of assorted fancy	6 00	4 00
12	Starch, 12 lbs. of Corn	2 00	1 00
13	Starch, 12 lbs. of Flour	2 00	1 00
14	Starch, 12 lbs. of Potatoe	2 00	1 00
15	Sugar, 20 lbs. of Beet Root	3 00	2 00
16	Sugar, 20 lbs. of Corn Stalk	3 00	2 00
17	Sugar, one loaf of Refined	5 00	3 00
18	Tobacco, 14 lbs. Canadian manufactured	4 00	3 00
19	Wheat Flour	5 00	3 00
20	Extra entries		

Class 44—Ladies' Work.

Sect.		1st Prize.	2nd Prize.
1	Braiding	$3 00	$2 00
2	Crochet Work	3 00	2 00
3	Embroidery in Muslin	3 00	2 00
4	Embroidery in Silk	3 00	2 00
5	Embroidery in Worsted	3 00	2 00
6	Gloves, three pairs	2 00	1 00
7	Guipure Work	3 00	2 00
8	Knitting	3 (0	2 00
9	Lace Work	3 00	2 00
10	Mittens, three pairs of woollen	2 00	1 00
11	Needle Work, ornamental	3 00	2 00
12	Netting, fancy	3 00	2 00
13	Plait for Bonnets or Hats, of Canadian Straw	3 00	2 00
14	Shirt, gentleman's	3 00	2 00
15	Socks, three pairs of woollen	2 00	1 00
16	Stockings, three pairs of woollen	2 00	1 00
17	Tatting	3 00	2 00
18	Wax Fruit	6 00	4 00
19	Wax Flowers	6 00	4 00
20	Worsted Work	3 00	2 00
21	Worsted Work (raised)	3 00	2 00
22	Extra entries		

Class 45—Machinery. Castings, and Tools.

Sect.		1st Prize.	2nd Prize.
1	Castings for General Machinery	$10 00	$6 00
2	Cast Wheel, spur or bevel, not less than 50 lbs. weight	8 00	5 00
3	Castings for Railways, Railroad Cars and Locomotives, assortment of	15 00	10 00
4	Edge Tools, an assortment	20 00	12 00
5	Engine, Steam, stationary, of one to four horse power, in operation	20 00	12 00
6	Engine, Steam, stationary, five horse power and upwards, in operation	30 00	15 00
7	Engine, Hot Air, one to four horse power, in operation on the ground	20 00	12 00
8	Pump, in metal	5 00	3 00
9	Refrigerator	6 00	4 00
10	Sewing Machine, manufacturing	10 00	7 00
11	Sewing Machine, family	10 00	7 00
12	Scales, platform	5 00	3 00
13	Scales, counter	3 00	2 00
14	Smoke Consuming Furnace, in operation on the ground	12 00	8 00
15	Tools for Working in Metals, assortment of	15 00	10 00
16	Turning Lathe	5 00	3 00
17	Valves and Gearing for working steam expansively, either in model or otherwise, principle of working to be the point of competition	12 00	8 00
18	Extra entries		

Class 46—Metal Work (Miscellaneous) including Stoves.

Miscellaneous.

Sect.		1st Prize.	2nd Prize.
1	Coal Oil Lamps, an assortment	$8 00	$6 00
2	Coppersmith's Work, an assortment	7 00	5 00
3	Fire Arms, an assortment	7 00	5 00
4	Files, collection of cast steel	3 00	2 00
5	Fire Proof Office Safe	8 00	6 00
6	Gas Fittings, an assortment	7 00	5 00
7	Iron Fencing and Gate, ornamental	7 00	5 00
8	Iron Work from the hammer, ornamental	6 00	4 00
9	Iron Work, ornamental cast	6 00	4 00
10	Locksmith's Work, an assortment	7 00	5 00
11	Nails, 20 lbs. of pressed	6 00	4 00
12	Nails, 20 lbs. of cut	6 00	4 00
13	Plumber's Work, an assortment	6 00	4 00
14	Sheet Brass Work, an assortment	7 00	5 00
15	Tinsmith's Work, an assortment	6 00	4 00
16	Tinsmith's Lacquered Work, an assortment of	6 00	4 00
17	Wire Work, an assortment	6 00	4 00
	Stoves.		
19	Cooking Stove, for wood, with furniture	6 00	4 00
20	Cooking Stove, for coal, with furniture	6 00	4 00
21	Hall Stove, for wood	5 00	3 00
22	Hall Stove, for coal	5 00	3 00
23	Parlour Stove, for wood	5 00	3 00
24	Parlour Stove, for coal	5 00	3 00
25	Parlour Grate	6 00	4 00
26	Extra entries		

Class 47—Miscellaneous, including Pottery and Indian Work.

Miscellaneous.

Sect.		1st Prize.	2nd Prize.
1	Brushes, an assortment	$6 00	$4 00
2	Model of a Steam Vessel	6 00	4 00
3	Model of a Sailing Vessel	6 00	4 00
	Pottery.		
4	Filterer for water	3 00	2 00
5	Pottery, an assortment	8 00	5 00
6	Sewerage Pipes, stoneware, assortment of sizes	10 00	6 00
7	Stoneware, an assortment	10 00	6 00
8	Slates for roofing	8 00	5 00
	Indian Work.		
9	Buckskin Mittens, one pair	2 00	1 00
10	Clothes Basket	2 00	1 00
11	Fruit Basket	2 00	1 00
12	Hand Basket	2 00	1 00
13	Moccasins, one pair of plain	2 00	1 00
14	Moccasins, worked with beads or porcupine quills, one pair	3 00	2 00
15	Extra entries		

Class 48—Musical Instruments.

Sect.		1st Prize.	2nd Prize.
1	Harmonium	$10 00	$6 00
2	Melodeon	6 00	4 00
3	Organ, Church	25 00	15 00
4	Piano, Square	15 00	10 00
5	Piano, Grand	15 00	10 00
6	Piano, Cottage	10 00	6 00
7	Violin	3 00	2 00
8	Extra entries		

Class 49—Natural History.

Sect.		1st Prize.	2nd Prize.
1	Birds—Collection of Stuffed Birds of Canada, classified, and common and technical names attached	$8 00	$6 00
2	Fishes—Collection of Native Fishes, stuffed or preserved in spirits, and common and technical names attached	8 00	6 00
3	Insects—Collection of Native Insects, classified, and common and technical names attached	8 00	6 00
4	Mammalia and Reptiles of Canada, stuffed or preserved in spirits, classified, and common and technical names attached, a collection	8 00	6 00
5	Minerals—Collection of Minerals of Canada, named and classified	8 00	6 00
6	Plants—Collection of Native Plants, arranged in their natural families, and named	8 00	6 00
7	Stuffed Birds and Animals of any country, collection of	8 00	6 00
8	Woods—Collection of the Woods of Canada, in boards two feet long, one side polished; also, a portion of the tree cut in sections, showing the bark	8 00	6 00
9	Extra entries		

Class 50—Paper, Printing, Bookbinding, and Type.

Sect.		1st Prize.	2nd Prize
1	Bookbinding (blank-book), assortment of	$5 00	$3 00
2	Bookbinding (letter-press), assortment of	5 00	3 00
3	Letter-press Printing, plain	5 00	3 00
4	Letter-press Printing, ornamental	5 00	3 00
5	Paper Hangings (Canadian paper), one dozen rolls, assorted	7 00	5 00
6	Printing, Wrapping, and Writing Papers, one ream of each	7 00	5 00
7	Printing Type, an assortment	7 00	5 00
8	Extra entries		

Class 51—Saddle, Engine Hose, and Trunk Makers' Work, anth.ed Lear

Saddlery, &c.

Sect.		1st Prize.	2nd Prize.
1	Engine Hose and Joints, 2¾ inches diameter, 50 feet of copper rivetted	$6 00	$4 00
2	Harness, set of double carriage	8 00	6 00
3	Harness, set of single carriage	6 00	4 00
4	Harness, set of team	5 00	3 00
5	Saddle, Ladies' full quilted	8 00	6 00
6	Saddle, Ladies' quilted safe	6 00	4 00
7	Saddle, Gentlemen's full quilted	7 00	5 00
8	Saddle, Gentlemen's plain shaftoe	5 00	3 00
9	Trunks, an assortment	8 00	6 00
10	Valises and Travelling Bags, an assortment	5 00	3 00
11	Whips, and Thongs, an assortment	6 00	4 00
12	Hames, four pairs of iron carriage or gig	3 00	2 00
13	Hames, three pairs of iron cased team or cart	3 00	2 00
14	Hames, six pairs of wooden team	3 00	2 00

Leather.

Sect.		1st Prize.	2nd Prize.
15	Belt Leather, 30 lbs.	3 00	2 00
16	Brown Strap and Bridle, one side of each	3 00	2 00
17	Carriage Cover, two skins	3 00	2 00
18	Deer Skins, dressed	2 00	1 00
19	Harness Leather, two sides	3 00	2 00
20	Hog Skins, for saddles, three	4 00	3 00
21	Patent Leather, for carriage or harness work, 20 feet	6 00	4 00
22	Skirting for saddles, two sides	4 00	3 00
23	Extra entries		

Class 52—Shoe and Boot Makers' Work, Leather, &c.

Boots, &c.

Sect.		1st Prize.	2nd Prize.
1	Boots, Ladies, an assortment	$7 00	$5 00
2	Boots, Gentlemen's sewed, an assortment	7 00	5 00
3	Boots, pegged, an assortment	5 00	3 00
4	Boot and Shoemakers' Tools, an assortment	8 00	6 00
5	Boot and Shoemakers' Lasts and Trees, an assortment	8 00	6 00
	Leather.		
6	Calf Skins	3 00	2 00
7	Calfskins, two morocco	3 00	2 00
8	Cordovan, two skins of	3 00	2 00
9	Dog Skins, two dressed	3 00	2 00
10	Kip Skins, two sides	3 00	2 00
11	Linings, six skins	3 00	2 00
12	Patent Leather for bootmakers, 20 feet	6 00	4 00
13	Sheep Skins, six coloured	3 00	2 00
14	Sole Leather, two sides	3 00	2 00
15	Upper Leather, two sides	3 00	2 00
16	Extra entries		

Class 53—Woollen, Flax, and Cotton Goods; and Furs and Wearing Apparel.

Sect.		1st Prize.	2nd Prize.
1	Bags, from flax or hemp, the growth of Canada, one dozen	$5 00	$4 00
2	Bags, one dozen cotton	4 00	3 00
3	Blankets, woollen, one pair	6 00	4 00
4	Carpet, woollen, one piece	8 00	6 00
5	Carpet, woollen stair, one piece	6 00	4 00
6	Cloth, fulled, one piece	6 00	4 00
7	Cloth, broad, one piece	6 00	4 00
8	Counterpanes, two	5 00	3 00
9	Cordage and Twines, from Canadian flax or hemp, assortment of	10 00	6 00
10	Check for horse collars, one piece	4 00	3 00
11	Drawers, factory made, woollen, one pair	4 00	3 00
12	Flannel, factory made, one piece	5 00	3 00
13	Flannel, not factory made, one piece	5 00	3 00
14	Flannel, scarlet, one piece	5 00	3 00
15	Fur Cap and Gloves	4 00	3 00
16	Fur Sleigh Robe	5 00	3 00
17	Gloves and Mits of any leather, an assortment	4 00	3 00
18	Horse Blankets, two pairs	5 00	3 00
19	Kersey for horse clothing, one piece	5 00	3 00
20	Linen Goods, one piece	5 00	3 00
21	Winsey, checked, one piece	5 00	3 00
22	Satinet, black, one piece	6 00	4 00
23	Satinet, mixed, one piece	5 00	3 00
24	Shirts, factory made, three woollen	5 00	3 00
25	Silk and Felt Hats	5 00	3 00
26	Stockings, and Socks, factory made, woollen, three pairs of each	4 00	2 00
27	Stockings, and Socks, factory made, mixed woollen and cotton, three pairs of each	4 00	2 00
28	Suit of Clothes of Canadian Cloth	10 00	6 00
29	Tweed, Winter, one piece	6 00	4 00
30	Tweed, Summer, one piece	6 00	4 00
31	Twines, linen and cotton, an assortment	3 00	2 00
32	Woollen Cloths, Tweeds, &c., an assortment	10 00	6 00
33	Woollen Shawls, Stockings, Drawers, Shirts, and Mits, an assortment	10 00	6 00
34	Yarn, white and dyed, one pound of each	2 00	1 00
35	Yarn, fleecy woollen for knitting, one pound	2 00	1 00
36	Yarn, cotton, two pounds	2 00	1 00
37	Extra entries		

Class 54—Foreign Manufactures.

Foreign Articles will be admitted for exhibition only; but Certificates will be awarded to any article of worth or peculiar merit.

REPORT OF MR. C. McNAUGHTEN.

To the Directors of the Board of Arts and Manufactures, Toronto.

GENTLEMEN,—I beg to draw up a report of my labors during the time which I have been engaged by your Board.

The first point east of Toronto where it may be said manufactures are carried on is Whitby. Although in a commercial point of view, from its fine harbour, and the quantity of produce of various kinds shipped therefrom, and the wide range of fine agricultural country in the rear and upon each side of it, yet it is not particularly noted for its manufactures; although, like other towns of the kind, it has its share of artizans and mechanics necessary for its local trade, yet, strictly speaking, the only manufactures of this place for export are those of pianos, and a foundry. The former of these, belonging to Mr. Rainer, has lately become of some notoriety; this does not consist of so much in the number made but in their excellence, both in richness and deepness of tone and fineness of finish, he has been awarded the first prize by the association for them. He can dispose of all he manufactures.

The foundry heretofore has been engaged in making ploughs and executing general custom work; it has, however, lately been enlarged and re-opened. It is the property of Mr. Brown, but the Messrs. Patterson's, of Belleville, have now an interest in it, and intend carrying on the manufacturing of mowing, reaping and threshing machines. This locality has not before had anything of the kind, although agents from Brantford and Richmond Hill have been located here. The reputation of the Messrs. Patterson's stand very high; their opening an establishment situated in such a fine agricultural County as Ontario, will ensure to themselves success, and become a great acquisition to the Town of Whitby.

OSHAWA.—This village is the next point east, although it is only classed as a village yet there is no town and few cities that can boast of or come near to the standard of manufacturing of this place. There are plenty of places where more manufactures are carried on, but I speak of the extent in one particular or separate branch in one shop.

The most important of these are, A. S. Whitney & Co., scythe, fork and hoe manufacturers; Joseph Hall, thrashing machine and clover mill manufacturer, and Fuller & Co., cabinet ware manufacturer.

The operations in the factory of A. S. Whitney & Co. for this year are 2,500 dozen scythes, 1600 dozen forks, 1000 dozen hoes; they also manufacture scythe snathes, cast steel rakes, and many other small wares suitable for garden culture, but taking the three first articles above enumerated, and putting them at their average cost, they will amount to over $50,000. A few years back such an article as a scythe manufactured in Canada was not to be had. Mr. Whitney has long enjoyed an extensive business in this line; he imported all his articles, but the protective duty imposed upon such induced him to open an establishment for the manufacturing of them here; his enterprise has met with the greatest success, it has been yearly increasing, and is destined to do so. The articles manufactured are of a high order and give entire satisfaction. Although the above large quantity is manufactured here, yet it is not a tithe of what is required in the Province. Those imported, especially from England, do not come up to the mark, the fault being in the tempering.

On first entering this establishment, the blowing of the many furnaces, and the heavy quick thump of the trip hammers, would lead one to believe that they were paying a visit to one of the establishments of Birmingham; but, notwithstanding the confused noise, everything was going on in the most orderly way, every one was busy and at his post. There are over fifty men employed, and each one is employed by the piece; they are obliged to make so many dozen per day. In this way the manufacturer can tell exactly how much each piece will cost, and what the value of each man is to him.

The making of scythes is unlike most other kinds of tools, for, while in ordinary cases—such as axe making—the one person can do the various parts necessary, in this establishment they pass through the hands of 8 persons before they are finished. They require workmen well skilled, for in either of the operations which they have to go through they are liable to be injured.

The establishment of Joseph Hall is also very extensive, it is confined to agricultural implements. He employs fifty men; they work by piece-work, but the men are able to make from $1.50 to $2.50 per day. He has turned out two hundred thrashing machines, fifty clover mills, 1,000 ploughs, (principally cast-steel mould board). The shop at present is in full operation, they are making clover mills; this is a new patent, and the only place in the Province where they are manufactured, they are the most complete machines of the kind now made. The clover in the straw is put into the mill, and when you next see it it is in the bag ready for market. It will thresh and clean up in this way from forty to fifty bushels per day; upon the old principle fifteen bushels per day was the very best that could be done, and if a little damp not over half that quantity.

Mr. Hall is also going to manufacture mowing and reaping machines, which will add another to the many of the same kind now rising up in various parts of the Province. The same motive power, an engine of 100 horse, is used by Messrs. Hall and Whitney, but so much has the business of each increased that the one is crowding the other. Mr. Hall has purchased Mr. Whitney's shops, and going still further to enlarge this already large establishment, in consequence of adding new branches to it.

Mr. Whitney has purchased a very fine water privilege, south of the station at Oshawa, where he is going to put up a very large establishment.

Messrs. Fuller & Co's establishment is one of considerable size and where a large amount of business is done. They keep from forty to fifty men employed, and the wages may be taken at an average of $1.25. There is a great portion of their furniture bought by the retail trade. The good character of their furniture is also well known; they have succeeded upon more occasions than one in carrying off first prizes. I believe they also send certain kinds of furniture to the United States and get remunerative returns. As the head of this establishment was not seen it was not convenient to obtain the extent of their operations.

Bowmanville.—There are two foundries which do a good local trade. Their principal operations are in ploughs, stoves, and general custom work, and occasionally, but to a limited extent, mill work.

Messrs. Norton & Odell do a good business in fanning mills, straw cutters, churns, washing machines, mangles, &c. The whole of the articles which they manufacture are of their own invention, and for which they have secured patents. Their fanning mill is perhaps one of the very best, they have secured a patent right for it in England.

Newcastle.—There is but one foundry here, it it the establishment of H. A. Massey. He manufactures agricultural implements of various kinds, and is a general machinist. He employs from twenty to twenty-five hands, and the best mechanics will make $2 per day. The reputation of this manufacturer is more particularly known to the public in his successful manufacturing of combined mowing and reaping and horse power threshing machines.

There are much larger establishments in the country, and some where more machines are turned out during the year, but from what we have seen and heard from others, we question whether any better workmanship or more serviceable machines are to be found in them.

Mr. Massey has for many years labored in perfecting these machines, keeping steadily in view the points most desirable, simplicity and durability of construction, ease of draft, perfection of work, lightness and cheapness. These he has in a great measure secured, and were we to judge by the number of machines sold (taking into consideration the extent of his works) we would say his labors have been duly appreciated by the public.

From the unlooked for increased demand he was unable to fulfil all orders for the past year. His operations for 1862 are to be upon a much more extensive scale. He has added to his premises another large workshop, which will give him additional facilities.

The following are some of his sales for the past year: 50 combined mowers and reapers, 20 threshing machines, 50 two horse steel cultivators, 200 fanning mills, 500 ploughs (most of these the steel mould board). He has also done a good business in mill castings and engine work. For common work he uses the "Scotch Pig Iron," but for his machines he uses American, which is firmer and tougher.

His machines have hitherto been combined, this year he is going to make a single mower, a perfect novelty, the whole weight of which, when completed, will only be 450 lbs. The draft, with a cut of 4½ feet, will be 200 lbs. The patentee of this machine is W. A. Woods, of Kossick Falls, U. S. It was patented in 1859, and so complete is it, and answering the wants of the agriculturist, that the demand is greater than the supply. That gentleman manufactured last year the almost incredible number of 8,000; of that number 1,500 were sold in England. We could scarcely believe this statement ourselves were it not from the reliable source from which it was obtained.

It is a two horse machine, it runs on two driving wheels placed 30 inches apart, each wheel is 24 inches in diameter. The frame rests upon and is firmly secured to the axle of the wheels, and supports the gearing and a seat for the driver. The finger bar is elastic, and is three eighths of an inch in thickness and made of steel; it is attached to the machine by one bolt, and can be easily removed by taking off one nut, and when placed upon the frame under the seat the machine can be driven from field to field as easily as a light cart. The knife is driven by a crank pin projecting from a well-adjusted balance wheel, which gives it a steady uniform motion. It has a rapid motion with a short stroke, which enables the machine to do good work when the team moves as slow as horses can walk. These machines can be easily and instantly thrown out of gear, thereby giving motion to the

driving wheels only when moving. They cut a swath of 4½ feet wide, and are warranted capable of cutting ten acres of grass per day.

These machines will be made of the best material, and for beauty and style of finish will, we believe, surpass anything heretofore offered in this class of machinery. Mr. Massey purposes selling them at $80 cash.

Orono.—Messrs. Hutton & Rowe have a foundry, their principal business is in ploughs, in which they do a good business; they also make box stoves, sugar kettles, and do general custom work. There are six hands employed, their average wages will be about $1.25.

James Dyer, wool carding and cloth dressing. This establishment does a very good country business. They turn out good cloth, flannel, blankets, &c. Their business is altogether local. The hard times which have existed throughout the country for the past year or two has rather increased their business, for farmers have doffed the broad cloth and taken to the homespun. We think this a wise policy, encourage home manufactures we say, such a policy will soon make our country prosperous.

Port Hope.—There are two iron-founders and machine shops of some size. That of Mr. Pollard's has lately been erected and driven by water power. He is engaged in manufacturing mowing and reaping machines, plows, and general work. He is not under full "blast" yet, we therefore cannot say the extent of his capabilities; we are aware, however, that his machines are highly spoken of. He has at present ten men employed, their average wages will be $1.25 per day.

Thomas Zealand is a general machinist. He manufactures agricultural machines, such as mowers, reapers and ploughs; he also does a good business in heavy mill work, and manufactures portable steam engines. He is now making a very fine engine of ten horse power; it is his intention to have it on exhibition this Fall in Toronto. This being a dull time of year he has not as many hands as he generally employs. The wages average $1.50 per day.

(*To be continued.*)

BOOKS ADDED TO THE FREE LIBRARY OF THE BOARD DURING THE MONTH.

CLASS VI.

Unique Fancy Ornaments, designed for the use of Silversmiths, Chasers, Die Sinkers, Modelers, &c., &c., 1 vol. 4to .... *F. Knight.*
Scroll Ornaments, do. do. 1 vol. 4to .... "

CLASS XIV.

Cotton Manufacture of Great Britain investigated and illustrated; with an introductory view of its comparative state in Foreign Countries. 2 vols. 12mo., 1861........ *Dr. Ure.*

CLASS XVIII.

Alphabetical Index of Patentees, 1 vol. 8vo, 1859........ *British.*
Chronological Index of Patents, 1 vol. 8vo, 1859 .... "
Subject Matter Index of Patents, 1 vol. 8vo, 1859........ "
Specification of Inventions, Letter Press, 26 vols. 8vo, 1859........ "
" " Plates, 33 vols. folio, 1859........ "
" " Abridgments, 8 vols. 12mo, 1859........ "

CLASS XIX.

Rules, Orders and Forms of Proceedings of the Legislative Assembly of Canada. Jouruals and Appendixes of the Legislative Council and Assembly of Canada, for 1861.

CLASS XX.

American Gas Light Journal, Vols. I. and II, for 1859–60 and 61........ *J. Murray.*
Scientific American, new series from vol. I........ *Munn & Co.*

CLASS XXII.

Transactions of the Board of Agriculture of Upper Canada, for the years 1855–6–7–8 and 9, 4 vols. 8vo.
Transactions of the Board of Agriculture of the State of Maine, for the years 1857–8–9 and 60, 4 vols. 8vo.
Transactions of the Board of Agriculture of the State of Illinois, for the years 1859 and 60, 1 vol. 8vo.

HAMILTON AND GORE MECHANICS' INSTITUTE.

The annual meeting of this Institution was held on the 28th of February, when the following gentlemen were elected the Board of Directors for 1862:—

President, F. J. Rastrick, Esq.; Vice President, A. McCallum, Esq.; Directors: Richard Bull, Dr. Craigie, Thomas McIlwraith, C. R Murray, George Murison, Alexander Stuart, H. M. Melville, Thomas Hilton, William McMichael.

We take the following extracts from the Report of the retiring Directors:—

"During the past year there has been a steady increase in the Membership of the Institution, with every indication of its continuance.

Number of Members as shown on the Register on the 1st February, 1861	396
Number joined since that date	168
	564
Number resigned, died, left town, or in bad standing on the books	89
Total number of Members, 1st Feb., 1862	475

"The Receipts of the year, as per Financial Statement, have amounted to $3,692 17½; the Expenditure to $3,549 64½; leaving a Balance in hand of $142 53.

The Final Balance Sheet shows Assets by cash in hand, value of Library, Furniture and Building, $25,179 38; Liabilities by Mortgage account and Interest, and outstanding debts, $13,059 54; Profit and Loss, $12,119 85.

"Total number of Books in the Library on the 1st February, 1862, 2,702 volumes.

"Since the close of the Financial year, however, your Directors are happy to say, that they have been enabled to make an addition to this most important branch of your Institution. Mr. Brydges, in presenting the usual Annual Grant of the Great Western Railway Company, stipulated that the sum of $100 be devoted to the purchase of Books. In this your Directors most willingly acquiesced to carry out Mr. Brydges' wishes. This they have done so far as lay in their power.

"It will thus be seen that the Library has participated in the improvement which has marked the other branches of the Institute.

"The cordial thanks of the Mechanics' Institute are due, and hereby tendered, to the proprietors of the papers hereafter named, for their continued liberality in supplying the Reading Room with the following publications, free of charge.

[Here follows a list of 36 periodicals.]

In addition to the free list referred to, the Directors report 54 other periodicals as being regularly received at the Reading Room.

"The Directors are gratified to find that the attendance at the News Room is largely increased; and in order to keep up the interest thus shown, they have used their utmost endeavours to have the most popular magazines and periodicals on the table at the earliest possible date after publication.

"Owing to the loss sustained by the course of Lectures given in 1860 and 1861, and the fact that the Lecture Season of this year was marked by an unfortunate war excitement, your Directors did not deem it prudent to organize a course. They regard the Lecture, nevertheless, as an Educational instrument which such an Institute as ours ought not to be without. They trust, therefore, that it will not be lost sight of.

"The Directors have much pleasure in stating that in the beginning of the month of August last, Isaac Buchanan, Esq., M. P. P., presented this Institution with the elegant Drinking Fountain which now stands in the Reading Room—the benefit of which appears to be fully appreciated by those visiting the room.

"Your Board have pleasure in referring to the efficient manner in which the Superintendent, Mr. Rutherford, continues to discharge the various duties devolving upon him. They believe that to his uniform courtesy, and the constant attention which he gives to the interests of the Institute, we are largely indebted for the present satisfactory condition of its affairs; and in consideration of which your Board would recommend that an increase of seventy-five dollars be made to his salary for the ensuing year.

"In conclusion, your Directors would congratulate the Members on the improved position of the affairs of the Institute, as compared with what they were twelve months ago. The amount of old debts paid off, the increase in the subscription list, and the additional sum derived from Rent of Hall, afford ample proof that progress has been made. They are sanguine that such will continue during the coming year, and believe that with an efficient Board of Directors, and the cordial coöperation of the individual members, your Institution may at no distant date, compare favourably with any similar Institution in the Province."

Resolutions of thanks were passed to the Directors, Superintendent, and Auditors; and also to C. J. Brydges, Esq., and the Directors of the Great Western Railway, "for the very handsome yearly donation of $400 to the Institute."

ABRIDGED SPECIFICATIONS OF ENGLISH PATENTS.

Full specifications of all English patents issued may be obtained on application to Bennet Woodcroft, Esq., Great Seal Patent Office, 25 Southampton Buildings, Holborn, London; the price of which—varying from 3d. to 5s. sterling—must be remitted by Post Office order, made payable at the Post Office, Holborn.

Lists of all specifications may be seen at the Free Library of Reference of the Board of Arts and Manufactures, Toronto, as published in the Commissioner of Patents Journal.

1773. T. Cobley. *A process for preserving and indurating timber, wood, and other vegetable matters, and for rendering the same non-inflammable.* Dated July 15, 1861.

Here a strong solution of potash, baryta, lime, strontia, or any of their salts, or of the salts of any

metallic or other base capable of forming an insoluble compound with hydro-fluo silica acid, is forced into the timber, wood, or other vegetable matter to be acted upon by hydraulic or other means, and this process is repeated until the wood, &c., is sufficiently charged or impregnated with the solution to enable it to withstand the influence of flame. After the impregnation has been thoroughly effected with any of the given solutions, hydro-fluo silicic acid is forced into the wood, &c., by analagous means, with a view to render the solutions insoluble.

1783. E. G. F. De La Provotais. *Extracting the fibres from genista scorparia (broom) and other application to manufacturing paper and fabrics, and also treating the washing waters so as to obtain dyeing products therefrom.* Dated July 15, 1861.

The patentee claims, 1. Preparing ligneous fibres from genista scorparia (broom) for the manufacture of paper, pasteboard, and also of fibres intended to be converted into fabrics. 2. Colouring products from the washing waters remaining after the treatment of the fibres.

1802. A. V. Newton. *An improved process and improved machinery for obtaining fibres from the stalks or leaves of fibre yielding plants.* (A communication.) Dated July 17, 1861.

The object of the first part of this invention is to obtain directly from stalks, or leaves of fibre-yielding plants, the fibres in the white state, and of full strength. To this end the fibres are separated from extraneous matter of the stalks or leaves (which have been cut from the plants before the sap has ceased to flow through such stalks or leaves and while they are yet in the green state) by breaking, beating, scraping, or combing, or by other like mechanical operation, the extraneous matter being removed from the fibres whilst the fibres are protected from the action of the colouring agents by the presence of water or other equivalent fluid, which will prevent the extraneous colouring matter of the plant from impregnating the fibres. The second part of the invention consists in an arrangement of mechanism, whereby the stalks or leaves are held firmly and introduced slowly to the action of rapidly-moving combs and scrapers, which break through, loosen, and scrape off the extraneous substances from the fibres. When this is effected, then the motion of the feeding mechanism is reversed. The portion so acted upon is by this reverse motion withdrawn, and the other ends of the stalks or leaves are presented in like manner to the action of the comb and scrapers.

1836. C. N. Kottula. *Certain new compositions to be used in the manufacture of soap.* Dated July 22, 1861.

This invention consists in forming new compositions, by mixing alum with caustic soda, or with soda ash. When the caustic soda composition is dissolved in water, and the soda ash composition in water to which lime has been added in the usual manner in making ley, purified leys are produced superior to any hitherto obtained for the manufacture of soap.

1894. E. H. Joynson. *Improved machinery or apparatus for disintegrating, crushing, or drawing out vegetable fibres.* Dated July 29, 1861.

The improved machine consists as a travelling endless table, composed of metal plates joined together in the form of an endless chain, which passes round two octagonal or prism rollers, to which motion is communicated from the prime mover by any convenient arrangement of gearing. A stationary table on which the vegetable fibre to be operated on is placed by the attendant, is situated at one end of the machine, and another table, inclined board, or suitable receptacle, to receive the disintegrated fibres after they have passed through the machine, is situated at the other end.

1947. M. A. F. Mennons. *An improved odontalgic elixer.* (A communication.) Dated August 6, 1861.

This consists in the preparation of a medical extract, applicable to the treatment of caries and other diseases of the teeth. This extract is obtained as follows:—To about ten quarts of cognac brandy are added cochlearia two and a quarter pounds (avoirdupois), milfoil, thirteen and a half ounces, pulverized cloves, one ounce, pulverized cinnamon, one ounce, pulverized cochineal, two ounces. The mass is left to infuse for fifteen days, after which it is filtered and completed by the addition of tincture of quinquina, ten ounces, concentrated essence of aniseed one and two third ounces, concentrated essence of mint, two-thirds of an ounce.

1956. W. Clark. *Improvements in bleaching and clarifying saccharine matters and an apparatus for the same.* Dated August 6, 1861.

This consists mainly in treating saccharine juices of all kinds, either in a heated or cold state, by animal black in a state of fine powder, together with argillaceous or other earths; stirring up the mixture with a suitable agitator. After stirring for a certain time, the juices are bleached by fine black argillaceous or other earths, and one or several jets of steam introduced into the mixture, which produces a violent effervescence, and sets the whole mixture in motion, and after continuing this for a certain time the juices will become bleached. A mechanical agitator may be used as well as the steam jets to produce more complete agitation of the liquid.

1997. A. Barclay. *Improvements in machinery or apparatus for raising, lowering, or moving heavy bodies.* Dated August 10, 1861.

Under one modification this crane consists of a main pillar or column, fitted in a footstep bearing, and movable or not about its axis. This pillar has jointed to it a jib extending upwards in angular direction, and having jointed to its free extremity a secondary jib or beam, which sustains the load to be raised or moved. This secondary jib or beam is jointed to the main jib at about one-third of its length from the upper extremity, which is connected to the main pillar by a connecting rod or radius bar. A pulley is fitted to the lower end of the secondary beam, over this the chain to which the load is attached is carried, and this chain is carried up over a pulley at the junction of the secondary beam and the radius bar, and down to an ordinary winding barrel, which is fitted to the main pillar, and may be actuated either by hand or steam-power. The hoisting chain is wound round the front of the barrel, and there is a second chain for drawing in the main jib, which is wound on a duplex barrel in a direction contrary to that

of the twisting chain. The free end of this second chain is attached to the upper end of the jib, where it is jointed to the secondary beam. The winding barrel on which the hoisting chain is wound is made with a second barrel, which runs loosely upon it, but is caused to rotate with the primary barrel by a clutch actuated by a hand lever. To raise the load, the primary barrel is put in motion, then if the second barrel is put into gear, the main jib is quickly drawn in, and the load moves inwards in a horizontal line, in readiness to be at once deposited in the truck, waggon, or other receptacle placed in readiness to receive it.

RULES AND REGULATIONS

Made by the Commissioners of Patents for Inventions, and by the Lord Chancellor and the Master of the Rolls, under the Acts 15 *&* 16 *Vic., cap.* 83, *and* 16 *and* 17 *Vic., cap.* 115. *Followed by Specimen Forms of the Provisional Documents printed on sheets of the prescribed size.*

First Set of Rules and Regulations under the Act 15 & 16 Vic., cap. 83, for the passing of Letters Patent for Inventions.

By the Right Honourable Edward Burtenshaw Lord St. Leonards, Lord High Chancellor of Great Britain, the Right Honourable Sir John Romilly, Master of the Rolls, Sir Frederic Thesiger, Her Majesty's Attorney General, and Sir FitzRoy Kelly, Her Majesty's Solicitor General, being four of the Commissioners of Patents for Inventions under the said Act.

Whereas a commodious office is forthwith intended to be provided by the Crown as the Great Seal Patent Office; and the Commissioners of Her Majesty's Treasury have, under the powers of the said Act, appointed such office as the office also for the purposes of the said Act:

I. All petitions for the grant of Letters Patent, and all declarations and Provisional Specifications, shall be left at the said Commissioners' office, and shall be respectively written upon sheets of paper of twelve inches in length by eight inches and a half in breadth, leaving a margin of one inch and a half on each side of each page, in order that they may be bound in the books to be kept in the said office.

II. The drawings accompanying Provisional Specifications shall be made upon a sheet or sheets of parchment, paper, or cloth, each of the size of twelve inches in length by eight inches and a half in breadth, or of the size of twelve inches in breadth by seventeen inches in length, leaving a margin of one inch on every side of each sheet.

III. Every Provisional Protection of an Invention allowed by the Law Officer shall be forthwith advertised in the London *Gazette*, and the advertisement shall set forth the name and address of the petitioner, the title of his invention, and the date of the application.

IV. Every Invention protected by reason of the deposit of a Complete Specification shall be forthwith advertised in the London Gazette, and the advertisement shall set forth the name and address of the petitioner, the title of the Invention, the date of the application, and that a Complete Specification has been deposited.

V. Where a petitioner applying for Letters Patent after provisional protection, or after a deposit of a Complete Specification, shall give notice in writing at the office of the Commissioners of his intention to proceed with application for Letters Patent, the same shall forthwith be advertised in the London *Gazette*, and the advertisement shall set forth the name and address of the petitioner and the title of his invention; and that any persons having an interest in opposing such application are to be at liberty to leave particulars in writing of their objections to the said application at the office of the Commissioners within twenty-one days after the date of the *Gazette* in which such notice is issued.

VI. The Lord Chancellor having appointed the Great Seal Patent Office to be the office of the Court of Chancery for the filing of Specifications, the said Great Seal Patent Office and the office of the Commissioners shall be combined; and the Clerk of the Patents for the time being shall be the Clerk of the Commissioners for the purposes of the Act.

VII. The office shall be open to the public every day, Christmas Day and Good Friday excepted, from ten to four o'clock.

VIII. The charge for office or other copies of documents in the office of the Commissioners shall be at the rate of twopence for every ninety words.

(Signed) St. Leonards, C.
John Romilly, M.R.
Fred. Thesiger, A.G.
Fitzroy Kelly, S.G.

Dated the 1st October, 1852.

By the Right Honourable Edward Burtenshaw Lord St. Leonards, Lord High Chancellor of Great Britain, and the Right Honourable Sir John Romilly, Master of the Rolls.

Ordered, that there shall be paid to the Law Officers and to their clerks the following fees:—

By the Person opposing a Grant of Letters Patent.

To the Law Officer	£2	12	6
To his clerk	0	12	6
To his clerk for summons	0	5	0

By the Petitioner on the Hearing of the Case of Opposition.

To the Law Officer	£2	12	6
To his clerk	0	12	6
To his clerk for summons	0	5	0

By the Petitioner for the Hearing, previous to the Fiat of the Law Officer allowing a Disclaimer or Memorandum of Alteration in Letters Patent and Specification.

To the Law Officer	£2	12	6
To his clerk	0	12	6

By the Person opposing the Allowance of such Disclaimer or Memorandum of Alteration, on the Hearing of the Case of Opposition.

To the Law Officer	£2	12	6
To his clerk	0	12	6

By the Petitioner for the Fiat of the Law Officer allowing a Disclaimer or Memorandum of Alteration in Letters Patent and Specification.

To the Law Officer	£3	3	0
To his clerk	0	12	6

(Signed) St. Leonards, C.
John Romilly, M.R.

Dated the 1st October, 1852.

Ordered by the Right Honourable Edward Burtenshaw Lord St. Leonards, Lord High Chancellor of Great Britain.

I. All Specifications in pursuance of the conditions of Letters Patent, and all Complete Specifications accompanying petitions and declarations before grant of Letters Patent, shall be filed in the Great Seal Patent Office.

II. All Specifications in pursuance of the conditions of Letters Patent, and all Complete Specifications accompanying petitions for the grant of Letters Patent, shall be respectively written bookwise upon a sheet or sheets of parchment, each of the size of twenty-one inches and a half in length by fourteen inches and three fourths of an inch in breadth; the same may be written upon both sides of the sheet, but a margin must be left of one inch and a half on every side of each sheet.

III. The drawings accompanying such Specifications shall be made upon a sheet or sheets of parchment, each of the size of twenty-one inches and a half in length by fourteen inches and three fourths of an inch in breadth, or upon a sheet or sheets of parchment, each of the size of twenty-one inches and a half in breadth by twenty-nine inches and a half in length, leaving a margin of one inch and a half on every side of each sheet.

IV. The charge for office or other copies of documents in the Great Seal Patent Office shall be at the rate of twopence for every ninety words.

(Signed) St. Leonards, C.

Dated the 1st October, 1852.

Note.—*It is recommended to Applicants and Patentees to make their elevation drawings according to the scale of one inch to a foot.*

Second Set of Rules and Regulations under the Act 15 & 16 Vic., cap. 83, for the passing of Letters Patent for Inventions.

By the Right Honourable Edward Burtenshaw Lord St. Leonards, Lord High Chancellor of Great Britain, the Right Honorable Sir John Romilly, Master of the Rolls, Sir Frederic Thesiger, Her Majesty's Attorney General, and Sir FitzRoy Kelly, Her Majesty's Solicitor General, being four of the Commissioners of Patents for Inventions under the said Act.

I. The office of the Directory of Chancery in Scotland, being the office appointed by the Act for the recording of transcripts of Letters Patent, shall be the office of the Commissioners in Edinburgh for the filing of copies of specifications, disclaimers, memoranda of alterations, provisional specifications, and certified duplicates of the register of proprietors.

II. All such transcripts, copies, and certified duplicates shall be bound in books, and properly indexed, and shall be open to the inspection of the public at the said office, every day from ten to three o'clock.

III. The charge for office copies of such transcripts, copies, and certified duplicates, recorded and filed in the said office, shall be at the rate of twopence for every ninety words.

IV. The Enrolment Office of the Court of Chancery in Dublin, being the office appointed by the Act for the enrolment of transcripts of Letters Patent, shall be the office of the Commissioners in Dublin for the filing of copies of specifications, disclaimers, memoranda of alterations, provisional specifications, and certified duplicates of the register of proprietors.

V. All such transcripts, copies, and certified duplicates shall be bound in books and properly indexed, and shall be open to the inspection of the public at the said Enrolment Office every day, Christmas Day and Good Friday excepted, from ten to three o'clock.

VI. The charge for office copies of such transcripts, copies, and certified duplicates, enrolled and filed as aforesaid, shall be at the rate of twopence for every ninety words.

VIII. A provision is to be inserted in all Letters Patent in the respect whereof a Provisional and not a Complete Specification shall be left on the application for the same, requiring the Specification to be filed within six months from the date of the application.

IX. No amendment or alteration, at the instance of the applicant, will be allowed in a Provisional Specification after the same has been recorded, except for the correction of clerical errors or of omissions made *per incuriam.*

X. The Provisional Specification must state distinctly and intellibly the whole nature of the invention, so that the Law Officer may be apprized of the improvement, and of the means by which it is to be carried into effect.

(Signed) St. Leonards, C.
John Romilly, M.R.
Fred. Thesiger, A.G.
Fitzroy Kelly, S.G.

Dated the 15th October, 1852.

Ordered by the Right Honourable Edward Burtenshaw Lord St. Leonards, Lord High Chancellor of Great Britain.

Every application to the Lord Chancellor against or in relation to the sealing of Letters Patent shall be by notice, and such notice shall be left at the Commissioners' office, and shall contain particulars in writing of the objections to the sealing of such Letters Patent.

(Signed) St. Leonards, C.

Dated the 15th October, 1852.

Third Set of Rules and Regulations under the Act 15 & 16 Vic., cap. 83, for the passing of Letters Patent for Inventions, and under the Act of the 16 & 17 Vic., cap. 115.

By the Right Honourable Robert Monsey Lord Cranworth, Lord High Chancellor of Great Britain, the Right Honourable Sir John Romilly, Master of the Rolls, Sir Alexander James Edmund Cockburn, Her Majesty's Attorney General, and Sir Richard Bethell, Her Majesty's Solicitor General, being four of the Commissioners of Patents for Inventions under the said Act of the 15 & 16 Vic., cap. 83.

It is ordered as follows:

Rule VII. of the Second Set of Rules and Regu-

lations of the Commissioners, dated the 15th October, 1852, is hereby rescinded.

I. Every application for Letters Patent, and every title of Invention and Provisional Specification, must be limited to one invention only, and no provisional protection will be allowed or warrant granted where the title or the Provisional Specification embraces more than one invention.

II. The title of the Invention must point out distinctly and specifically the nature and object of the Invention.

III. The copy of the specification, or Complete Specification, directed by the Act 16 & 17 Vic., cap. 115, sec. 3, to be left at the office of the Commissioners on filing the specification or Complete Specification shall be written upon sheets of brief or foolscap paper, briefwise, and upon one side only of each sheet. The extra copy of drawings, if any, left with the same, must be made as heretofore, and according to the directions contained in Rule III. of the Lord Chancellor, dated the 1st October, 1852.

IV. The copy of the Provisional Specification to be left at the office of the Commissioners on depositing the same shall be written upon sheets of brief or foolscap paper, briefwise, and upon one side only of each sheet. The extra copy of drawings, if any, left with the same, must be made as heretofore, and according to the directions contained in Rule II. of the Commissioners, dated the 1st October, 1852.

V. All specifications, copies of specifications, provisional specifications, petitions, notices, and other documents left at the office of the Commissioners, and the signatures of the petitioners or agents thereto, must be written in a large and legible hand.

VI. In the case of all petitions for Letters Patent left at the office of the Commissioners after the 31st day of December, 1853, the notice of the applicant of his intention to proceed for Letters Patent for his Invention shall be left at the office of the Commissioners eight weeks at the least before the expiration of the term of Provisional Protection thereon, and no notice to proceed shall be received unless the same shall have been left in the office eight weeks at the least before the expiration of such Provisional Protection; and the application for the warrant of the Law Officer and for the Letters Patent must be made at the office of the Commissioners twelve clear days at the least before the expiration of the term of Provisional Protection, and no warrant or Letters Patent shall be prepared unless such application shall have been made twelve clear days at the least before the expiration of such provisional protection: Provided always, that the Lord Chancellor may in either of the above cases, upon special circumstances, allow a further extension of time, on being satisfied that the same has become necessary by accident, and not from neglect or wilful default of the applicant or his agent.

(Signed) CRANWORTH, C.
JOHN ROMILLY, M.R.
A. E. COCKBURN, A.G.
RICHARD BETHELL, S.G.

Dated the 12th of December, 1853.

RULE IN RESPECT OF APPLICATION TO THE LORD CHANCELLOR TO EXTEND THE TIME FOR SEALING LETTERS PATENT.

By the Right Honourable Robert Monsey Lord Cranworth, Lord High Chancellor of Great Britain.

Whereas by the Act 16 & 17 Vic., cap. 115, the Lord Chancellor is empowered to extend the time for the sealing of Letters Patent for an Invention, and for the filing of the Specification thereon, limited to the period of one month after the expiration of the six months of provisional protection of such Invention, provided the delay in sealing such Letters Patent and in filing such Specification has arisen from accident, and not from the neglect or wilful default of the applicant.

It is Ordered as follows:

Every petition addressed to the Lord Chancellor, praying for the extension of time for the sealing of Letters Patent, and for the filing of the Specification thereon, under the provisions of the Act of the 16 & 17 Vic., cap. 115, and the affidavit accompanying the same, shall be left at the office of the Commissioners of Patents. And in every case where the delay in sealing such Letters Patent before the Law Officer to whom such objections may have been referred, the petitioner, before leaving his petition as aforesaid, shall obtain the certificate of such Law Officer, to the effect that the allegations in respect of such adjourned hearings and causes of delay are in the opinion of such Law Officer correct, and that the delay arising from such adjourned hearings has not been occasioned by the neglect or default of the petitioner. And such certificate shall be written at the foot or shall be annexed to such petition.

(Signed) CRANWORTH, C.

Dated this 17th day of July, 1854.

PETITION.

To the Queen's Most Excellent Majesty.

The humble Petition of —— ——

Sheweth,

That Your Petitioner —— —— in possession of an Invention for —— which Invention —— —— believe will be of great public Utility; that*

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and that the same is not in use by any other Person or Persons to the best of —— —— knowledge and belief.

Your Petitioner therefore humbly prays that Your Majesty will be pleased to grant unto —— —— Executors, Administrators, and Assigns, Your Royal Letters Patent for the United Kingdom of Great Britain and Ireland, the Channel Islands, and the Isle of Man, for the term of Fourteen Years, pursuant to the Statutes in that Case made and provided.

And Your Petitioner will ever pray, &c.

Her Majesty is pleased to refer this Petition to Her Majesty's —— General to consider what may be properly done therein.

Clerk of the Commissioners.

The words in the Act are * "that he is the first and true Inventor," which must be used when not a communication.

The name and address of the Petitioner, and the title of the Invention, to be written very legibly.

DECLARATION.

—— —— do solemnly and sincerely declare that —— —— in possession of an Invention for —— which Invention —— —— believe will be of great public Utility; that

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and that the same is not in use by any other Person or Persons to the best of —— —— knowledge and belief, and —— —— make this Declaration, conscientiously believing the same to be true, and by virtue of the provisions of an Act made and passed in the Session of Parliament held in the fifth and sixth years of the Reign of His late Majesty King William the Fourth, intituled "An Act "to repeal an Act of the present Session of Parlia- "'ment, intituled, 'An Act for the more effectual "'Abolition of Oaths and Affirmations taken and "'made in various Departments of the State, and "'to substitute Declarations in lieu thereof, and "'for the more entire Suppression of voluntary "'and extra-judicial Oaths and Affidavits,' and to "make other provisions for the abolition of unne- "cessary Oaths."

*

Declared at —— this —— day of —— in the Year of our Lord 185 ,
Before me,

To be signed by the Party making the Declaration, where the Asterisk is placed.

PROVISIONAL SPECIFICATION.

—— —— do hereby declare the nature of the said Invention for ——

BRITISH PUBLICATIONS FOR FEBRUARY.

	£	s.	d.	
Basham (W. R.) On Dropsy connected with Disease of the Kidneys, 2nd ed, 8vo	£0	9	0	*Churchill.*
Bemrose (W. J.) Manual of Wood Carving, &c., 4to	0	5	0	*Whittaker.*
Beveridge (Henry) Comprehensive History of India, vol. 2, illustrated, sup. royal, 8vo	1	1	0	*Blackie.*
Bland (Wm.) Principles of Construction in Arches, Piers, &c., new ed., 12mo.	0	1	6	*Weale.*
Bohn's Pictorial Hand-Book of Geography, 2nd edition, corrected, post 8vo., 6s.; cold	0	7	6	*Bohn.*
——— Stand. Liby. Luther's Life, by Himself, arranged by Michelet, post 8vo	0	3	6	*Bohn.*
Brown (Henry) Victoria as I Found It during Five Years of Adventure, post 8vo	0	10	6	*Newby.*
——— (J.) Course of Drawing for Primary Schools, Part 1, 6s.; Part 2	0	8	0	*Longman.*
Buckingham (Richard Duke of) Private Diary, 3 vols. post 8vo	1	11	6	*Hurst & Black.*
Cambridge Senate House Examination Papers, 1860–61, cr. 8vo	0	2	6	*Macmillan.*
Cariboo, the newly-discovered Gold Fields of British Columbia, cr. 8vo	0	1	0	*Darton.*
Cassell's Educational Series, DeLolme's French Reader, new ed., 12mo, 2s, sd.	0	2	6	*Cassell.*
Chemical Society Quarterly Journal, vol. 14 (1861)	0	13	0	*Baillière.*
Chichester Cathedral, The Architectural History of, by Rev. R. Willis, &c. 4to.	1	10	0	*Bell & Daldy.*
Churchill (C. C. H) Druzes and the Maronites under the Turkish Rule, post 8vo., 5s.; 8vo	0	10	0	*Quaritch.*
Ciceronis Orationes, vol. 1, with Commentary by G. Long, 2nd ed., 8vo	0	16	0	*Whittaker.*
Clinton (H. F.) Fasti Romani, an Epitome of the Chronology of Rome and Constantinople, 8vo	0	7	6	*Oxford University Pr.*
Combe (George) Elements of Phrenology, 9th ed., cr. 8vo	0	3	6	*Simpkin.*
Crabbe (Rev. G.) Life of, with his Letters and Journals, by his Son, fcap. 8vo., reduced to	0	3	0	*Murray.*
Cranborne (Viscount) Historical Sketches and Reviews, 8vo	0	12	0	*Mitchell.*
Cust (Hon. Sir E.) Annals of the Wars of the 18th Century, 3rd ed., 5 vols. 12mo. each	0	5	0	*Murray.*
Cutler (G. O.) Philosophy of Intellectual Education, Ancient and Modern, sm. post 8vo	0	3	6	*Simpkin.*
Dalhousie (Marquess of) Administration of British India, by Edwin Arnold, vol. 1, 8vo	0	15	0	*Saunders & O.*
Dalzel (Andrew) History of the University of Edinburgh, with Memoir, 2 vols. 8vo	1	1	0	*Edmonston.*
Davidson's Choral Services of the Church of England, oblong	0	5	0	*Musical Publishing Co.*
Drayson (Capt. A. W.) Common Sights in the Heavens and how to See them, fcap. 8vo	0	8	0	*Chapman & Hall.*
Dublin Examination Papers for 1862, 12mo	0	2	6	*Longman.*
Duke of York's (The) Campaign in Holland in 1799	0	2	6	*W. Mitchell.*
Eadie (J.) Ecclesiastical Encyclopœdia; or, Dictionary of Christian Antiquities, Sects, &c., post 8vo	0	8	6	*Griffin.*
Edgar (J. G.) Memorable Events of Modern History, illust., cr. 8vo	0	6	6	*W. H. Allen.*
Education (The) of the Middle Classes, by A. B.	0	1	0	*J. H. & J. Parker.*
Field Exercise and Evolutions of Infantry, as revised by H. M. Command, 1861, 18mo	0	1	0	*Parker & Son.*
Frome (Col.) Method of Conducting a Trigonometrical Survey, 3rd edition, revised, 8vo	0	12	0	*Weale.*
Gairdner (W. T.) Public Health in Relation to Air and Water, fcap. 8vo	0	7	6	*Edmonston.*

Guernsey (E.) Homœopathic Domestic Practice, ab. and ed. by H. Thomas, 3rd edition, fcap. 8vo	0	5	0	*Turner.*
Handbook (The) of the Court, Peerage and House of Commons, 1862, r. 16mo.	0	5	0	*P. S. King.*
Hastings (J.) Medicinal Value of Excreta of Reptiles in Phthisis, &c., p. 8vo.	0	5	0	*Longman.*
Heale (James Newton) On the Phisiological Anatomy of the Lungs, 8vo	0	8	0	*Churchill.*
History of Printing, new edition, fcap. 8vo	0	2	6	*Society Pr. Ch. Kn.*
Johnston (Keith) Physical Atlas of Natural Phenomena, new edition, imp. fol. reduced to	8	8	0	*Blackwoods.*
Life Amongst the Colliers, post 8vo	0	5	0	*Saunders & O.*
Lillywhite's Guide to Cricketers, winter ed., 1862, 12mo	0	1	3	*Lillywhite.*
Lucas (Capt. T. J.) Reminiscences of a Campaign in South Africa, il. sm. fol.	1	1	0	*Day & Son.*
Macduff (Rev. J. R.) Sunsets on the Hebrew Mountains, 4th thous., p. 8vo	0	6	6	*Nisbet.*
Men of the Time: a Biographical Dictionary of Eminent Living Characters, new edition, cr. 8vo	0	10	6	*Routledge.*
Railway Construction, Instructions on the Science of, new ed., 12mo	0	1	6	*Weale.*
Ruffin (S. M.) Chronological Tables of Contemporary Sovereigns, Dates, &c., 2nd ed., royal 4to	0	3	6	*Lockwood.*
Sharpe (S.) Egyptian Antiquities in the British Museum, post 8vo	0	5	0	*J. R. Smith.*
Timbs (John) School-Days of Eminent Men, 2nd ed., revd., &c., fcap. 8vo	0	5	0	*Lockwood.*
——— Year Book of Facts in Science and Art, 1862, fcap. 8vo	0	5	0	*Lockwood.*
Tourrier's Model Book, 7th ed., post 8vo	0	6	6	*Nutt.*
Weale's Rudy. Ser., v. 3. Bland on Arches, Piers, Buttresses, &c. n. ed, 12mo.	0	1	6	*Weale.*
——— v. 61. Arman (A.) Land Measurem't Ready Reck'r, 12mo.	0	1	6	*Weale.*
——— v. 62. Science of Railway Construction, new ed., 12m	0	1	6	*Weale.*
Wood (Rev. J. G.) Illustrated Natural History, new ed., sm. cr. 8vo	0	6	0	*Routledge.*

AMERICAN PUBLICATIONS FOR MARCH.

Bullion (Rev. P.) Copious and Critical Latin Dictionary, 8vo	$3 00	*Sheldon & Co.*
Dana (A. H.) Ethical and Physiological Inquiries, 12mo	1 00	*Scribner.*
Davis (A. J.) Medical Prescriptions for the Human Body and Mind, 12mo	1 00	*A. J. Davis & Co.*
Harbison (J. S.) The Bee-keeper's Directory; or, the theory and practice of Bee Culture in all its departments, 12mo	1 75	*H. H. Bancroft & Co.*
Hittell (John S.) Mining in the Pacific States of North America, 16mo	1 25	" "
New (The) American Cyclopœdia, vol. 14, Reed, Spire, 8vo	3 00	*Appleton & Co.*
Van Ness (Capt. W. W.) Elementary Work on Military Tactics, 16mo	0 50	*Carleton.*
Whitmore (Wm. H.) A Hand-Book of American Genealogy, 4to	3 00	*Joe Munsell.*

Correspondence.

To the Editor of the Journal of the Board of Arts and Manufactures, Upper Canada.

MONTREAL, March 13, 1862.

SIR—Having been much interested in the progress of your Board, and all matters pertaining thereto since its inception, I wish to make a few suggestions in reference to matter which I believe it would be profitable to introduce into the pages of the *Journal*; to give you something of the results of my observation of a four months' residence here, during what may be termed the season of instruction to mechanics and others of the industrial classics.

In the first place, I think it would be very advantageous to builders, contractors, and the public generally, if the architects and engineers were invited by circular or through the *Journal* to furnish the amount of the tenders for works of any importance in like manner as they are given in the *Builder*, published in London, England; and also if a price list of raw material at the different leading points, similar to market price lists usually published in the ordinary papers of the day—was furnished.

The Mechanics' Institute of Montreal, from what I have seen of it during my residence, is energetically conducted, and I cannot help observing that I never knew a President so indefatigably attentive as Mr. Munro. There have been several classes in successful operation, more especially the drawing, geometrical, ornamental and the French classes. The reading room is well supplied with newspapers and periodicals, and is largely attended, but there have not been any lectures delivered under the auspices of the Institute, and in fact there have been but few lectures of any practical usefulness to mechanics as such, by any other of the associations. True, the series of lectures called the Somerville Lectures, at the rooms of the Natural History Society, have been very interesting and pleasing, and well attended, but chiefly by the juvenile part of the community, for which they were intended, and also the series under the Young Men's Christian Association have been of a very intellectual and moral character, and have also been well attended by the religious portion of the population but the void remains. Musical entertainments

have predominated, and are very numerously attended.

It is much to be regretted that the Board of Arts here are not in that position of usefulness which it is desirable it should be. The construction of the Exhibition building has so involved it in debt, that without some extraordinary relief or assistance it cannot move; but I hope that the Government will be able to possess the building for some public purpose and give the Western Board something like an equivalent, one item of which I would suggest should be duplicates of all useful material in the collection of the geological survey.

I am, dear Sir, yours very obediently,

J. E. P.

THE ANTIQUITY OF MAN.

The lecture recently delivered by Professor Huxley, at the Royal Institution, on the Fossil remains of man was bold, comprehensive, and eloquent. After glancing at the different forms of human heads in different parts of the world, the professor said:—Passing to the old world, accurate knowledge was confined in Europe. Archæology shows us beyond the middle ages and beyond the epoch of the Romans, another group, a longheaded people of Germanic origin, well acquainted with the use of iron. Beyond this came another race of greater antiquity, of smaller stature, and in general character more like the Hindu, who worked in bronze. Beyond this again, archæologists produce another race, neither characterized by manufactures of iron nor of bronze, but forming their weapons and tools of the hardest stone. These stone implements are found in their tumuli, with the skeletons of the race who made them. The buried warrior is found sitting upright, with his heavy stone axe beside him, ready to meet, in the "fields of happiness," his companions or his enemies face to face. The crania of these people were rounder than those of the iron or of the bronze age; and some of them had flat foreheads and strong ridges over the eyes, with large but not prognathic jaws. Such were the skulls of the people of the stone epoch. If it be asked, how far distant was this stone epoch in time, it would be difficult to give the precise date beyond the birth of history, and yet there is a mode by which the period can be given with considerable comparative accuracy.

Denmark is covered by numerous peat-bogs, often very deep. In digging into these, trees, which have fallen in, are often met with—great beech trees, such as are now the glory of the country. Digging deeper, we come to the relics of another forest—a forest of oaks, large, too, in size, with their tops lying towards the centre of the bog. Cutting down again still lower, we meet with yet another buried forest, neither of beech, nor of oak, but of pine,—great trees of 3 or 4 feet in diameter, and with the straightest trunks, showing themselves thus of forest growth. In the memory of man there have been no other trees than beech. The climate of the country, then, must have changed since the ancient growth of oaks; it must have changed again since the indigenous growth of the pine forests.

Men of the iron age are found in the peat; beneath the oak forest men of the bronze epoch; and from beneath the pines the stone implements of those of the stone age are brought to light. Still lower, in the lowest peat, there are no weapons, no traces of man at all. What is meant by this chronicle, not of time, but of facts? How vast must be its remoteness if measured by ordinary human standards? But so far as we have yet been speaking, the physical geography of the earth remained like to what it is, with rivers running in their present channels, sea coasts bounding seas of like extent, while the dry land of to-day was dry land then, The hill-caves too, were high and dry, without water flowing through them.

By a singular accident we have gained a knowledge of the habits of these stone-workers, and from their refuse bone-heaps we know that in Denmark they hunted the Aurochs and the *Bos primigenius*. We know that these "stone" people built huts on piles in the lakes of Switzerland, what implements they had, what weapons, what food. The animals which supplied the last were much the same as now, except the *Bos urus* and *Bos primigenius*.

Beyond all traces of the stone age, there was an utterly different period—a time when what is now sea and seashore held different relations, when what was forest and much of what is now dry land was under water, when other rivers flowed in other channels, and have left their deposits now raised a hundred feet above the flow of existing rivers—a time when the physical features of the country were altogether different. And when we arrive at this age we find the whole fauna of the region to be largely changed.

Mammoths and rhinoceroses swarmed over the land, just as badgers and weasels do now, and their bones, with those of the cave-bears and hyænas, have been washed down in the *débris* of the soil and preserved. Where was man in that age? Until within a few years the answer would have been, "Not there." Preconceived belief was so strong that, although the evidence existed thirty years ago, his presence was ignored. But of late the proofs have so rapidly accumulated as to break down all the barriers of predjudice, and the evidence that man was associated with the *Bos primigenius*, the cave-bear, and tichoner rhinoceros, by the discovery, within the last few years, of such numbers of his worked flint implements—not ground to a face or edge, but simply chipped into form—in proximity to the bones of those great beasts, has been so well authenticated that no instructed person now doubts for one moment the contemporaneity of man with the mammoths.

ON SUBSTITUTES FOR RAGS IN PAPER MAKING.

During the last five or six years the paper manufacture has been in an extraordinary state of, if we may use such an expression, disturbed equilibrium. First came a sort of furore for the discovery of some material to take the place of rags, the supply of which, it was believed, was fast becoming insufficient to meet the constantly increasing demand. After that set in the agitation in connection

with the repeal of the duty upon paper; and so the whole trade has been kept in a state of uncertainty to the present moment.

With respect to the discovery of new materials of a fibrous character, fit for paper making, a great deal has been written and said, and a vast amount of time spent, we may say wasted, in investigations, which would never have been the case had the authors, and speakers, and experimenters possessed any real knowledge of the requirements of the paper maker. And so slight has been the advancement made by virtue of all these exertions that the question remains practically very much where it was at the beginning; indeed, none but the experienced manufacturer knows how very difficult this problem is, and how very little progress has been made towards its solution. It is a popular idea that any fibrous material from which a sheet of paper can be made may be applied to the uses of the paper maker; there can be no greater fallacy; almost any vegetable material can in fact be converted into paper, there are scores of substances which can be readily bleached, beaten into pulp, and converted into good, some into excellent, paper. But there are many things to be thought of besides this, and it is really going but a very little way into the actual question of the substitution of other materials for rags in a commercial sense. The real gist of this question lies in the implication that any material to substitute rags must produce paper equal to that from rags at less, or at least not greater cost. The new material must yield paper equally good with rag paper, and costing no more. This being the question, is there any material which can be said to, in any wise, take the place of rags in paper making? At present there is none. Although almost every conceivable fibrous substance has been the subject of experiment, and most of them of patent, in relation to paper, and although numberless ingenious and active minds are ever at work upon this object, there is not, at the present time, any new raw material employed in paper making, with the exception of straw, and perhaps a comparatively small quantity of the Esparto, or Spanish grass; and with respect to straw the use is almost wholly exceptional, as the paper can scarcely be ranked with rag paper. In applying any of these prepared fibrous materials to the manufacture of paper in competition with rags, there are many important points for consideration. In the first place (and this forms a sort of standard to which the question must constantly be referred), rags are a refuse material; throughout the civilized world rags are produced spontaneously, as it were, with as much certainty as time passes away; it requires neither capital nor industry; neither sowing nor reaping; neither sunshine nor rain, to produce rags; changes of season, commercial crises do not interfere with their production; within narrow limits, therefore, the supply is certain and invariable. Add to this that rags are a material already prepared to the hand of the paper maker, they have already undergone treatment which must be applied in a greater or less degree to all fibrous substances before they can be fitted for his use, and that, above all, rags are perfectly suited to the object in question, so that, irrespective of cost and trouble of manufacture, no substance has been discovered capable of producing paper equal in all respects to that made from rags. The fact that rags are refuse material places a difficulty, *in limine*, with respect to the introduction of raw material, properly so called, to take their place. Raw material must be raised by cultivation, which requires labour and capital; it must be dependent upon the character of the seasons, and upon a hundred circumstances which will affect the certainty of the supply, and enhance the cost—that is, the first cost. Coming then to the paper maker, it requires to be treated by peculiar methods irrespective of paper making but necessary to reduce the crude material to a manageable form; and then comes lastly the comparison between the new substance and rags, in facility of working, and in the quality of paper produced.

It is generally believed that linen enters much more largely into the composition of fine paper than is really the case. Cotton is by far the more staple commodity, and constitutes probably at least four-fifths of the best papers. The fibre of cotton is remarkably adapted to the production of a fabric like paper, in which the strength is wholly due to a natural interlacing of the fibres similar to what exists in felt. Examined under the microscope, it will be seen that the fibres in paper run in every possible direction, intertwining and winding about each other so as to give firm consistency and considerable strength. It is not every kind of vegetable fibre which possesses the property of interlacing together in this manner, and paper made from fibre deficient in this property can never be equal to paper made from linen and cotton, which do possess it pre-eminently. The fibre from many vegetable substances is almost straight, the fibres laying together naturally in fasiculi or bundles, and devoid of the curling property by which the fibres are enabled to twist themselves together when the natural structure is broken down—such matters will never make a good tenacious paper. Other fibrous materials are naturally endued with, that is cemented together by, or encased in, substances which must be wholly removed before the paper maker can avail himself of their otherwise valuable qualities; in flax, for instance, the fibre is encased in a coating of siliceous matter, which, when the structure of the plant is broken down, developes itself in what is technically called shive. In preparing flax for textile purposes the shive is removed by various processes, the value of the material being sufficient to justify the outlay; but if the same outlay were incurred upon raw flax for the uses of the paper maker, the value of flax thus prepared would exceed that of the best linen rags; and this brings us back to the starting point, that all new materials have to contend with a refuse material in paper making.

It would be a vain and humiliating thing to say that as knowlege advances no substitute can be found to take the place of rags in the paper mill. In all probability the reverse will be the case, and the time will come when cheap and appropriate substances will be produced, affording to the paper maker a regular and economical supply of raw material, as suitable to his use as rags now are; but there are many things to be considered before it can be assumed that any substance, simply because it is found by experiment capable of being converted into paper, will become a competitor with rags on the commercial scale.

It will be remembered by most of our readers,

that some time since the proprietors of the *Times* newspaper offered a splendid premium for the production of a new raw material which could be employed in paper-making in substitution of rags. What was the result of this offer, which is known to have been entirely *bonâ fide?* Simply nothing, but about two years of constant trouble to the appointed referees, leaving the question at issue just where it was when the premium was offered, and where it remains at the present moment.—*The Artizan.*

DIALYSIS, AND ITS APPLICATION TO THE MANUFACTURING ARTS.

Under the title of dialysis a most remarkable series of phenomena has been brought before the notice of the scientific world by Mr. Graham, the Master of the Mint. His discoveries on this subject are the result of a carefully conducted series of laborious experiments extending over a long term of years. They offer to those who can afford the time necessary to trace them, step by step, as they have been published in the Transactions of the Royal Society, a most instructive example of the progressive growth of a series of inductive experiments, at first purely abstract, without any evident practical bearing, but eventually resulting, as all scientific truths must result, in extending man's dominion over natural objects, and thus aiding the arts of life and civilisation. The steps of the progressive discoveries of Mr. Graham are hardly suited to our pages, or to the wants of the readers of a journal so essentially practical as the *Mechanics Magazine.* We propose, therefore, to take the facts as they are now ascertained, and to show their practical bearing upon many of the manufacturing arts.

Dialysis depends upon the circumstances ascertained by Mr. Graham, that certain solutions possess the power of diffusing themselves through water with very great facility, and that others do not possess this property. In a very rough and coarse manner these facts might be illustrated by the following examples:—Suppose four deep glasses to be taken, and in one to be placed a few grains of common salt; in the second an equal quantity of sugar; in the third, gum; and in the fourth, albumen, or dried white of egg. Let us now imagine the glasses to be each filled up with water, but with such precautions as should entirely prevent any agitation of the contents of the vessel. If the whole were left undisturbed, the solids, after a short time, would dissolve, and their solutions, being heavier than water, would remain at the bottom of the vessel in obedience to the law of gravity. But this law would soon be counteracted by another, namely, that of diffusion. The solution of salt, for example, would, in opposition to gravity, gradually rise and diffuse itself through the whole liquid. The solution of sugar would follow the same course, but with less than half the rapidity of the solution of salt. The gum, again, would be four times longer in mixing itself than the salt; when the albumen would require nearly twenty times the time. In fact, so different is the diffusive power of a solution of salt and one of albumen, that supposing the two mixed together, the salt would diffuse itself in the water, leaving the albumen in a pure state. On examination, it is found that those bodies are most diffusible which are crystaline, and that those are the least so which have an uncrystallizable character, and resemble gum, glue, and albumen, in this respect. As convenient names for these two classes of bodies, Mr. Graham has proposed the terms *crystalloids* and *colloids.*

Another fact of great importance with regard to the right of understanding of the phenomena of diffusion is, that a solution of a diffusible substance or crystalloid will diffuse itself into, or through, a solution of a colloid body almost as rapidly as through pure water—but that the solution of another colloid body possesses no such power. It is upon this last fact that the practical application of dialysis and the construction of the dialyser depend. This instrument may be compared in form to a tambourine, in which the flat circle is formed of gutta-percha rings, and the membrane consists of parchment paper (a singularly tough imitation of animal parchment, obtained by the action of sulphuric acid on ordinary paper). If a liquid be poured into the dialyser it does not pass through by filtration, parchment paper being impervious to the mechanical passage of fluid. But if the dialyser be floated on pure water, and then a mixed solution of a colloid and a crystalloid substance be poured into it, the latter rapidly diffuses itself through the substance of the parchment paper into the water beneath the colloid remaining behind. By this simple means the solution is separated into two parts, or *dialysed.*

Simple as this operation may appear, and as it really is, it gives us a power that we have never before possessed, namely, that of separating in the most easy and least expensive manner any mixture of different substances belonging to these two groups. Thus, a solution of sugar and gum is placed in the dialyser; the sugar passes through, the gum remains behind. A solution of white arsenic is mixed with a variety of substances, such as would constitute the contents of the human stomach; this is thrown into a dialyser, when the arsenic, being crystalloid, passes through into the clear water, and can be readily discovered by the usual tests, whilst the mixture of the various colloids, constituting the food, remains.

It is, however, in the power it affords of obtaining pure solutions of substances hitherto thought insoluble that the process offers the greatest advantages. Thus, by its aid have been obtained perfectly pure solutions of silica or flint, alumina or the basis of clay, of peroxide of iron, Prussian blue, oxide of tin, and a variety of substances of the same insoluble character.

Let us take flint, for example. It is usually regarded as one of the most insoluble bodies known; but by the aid of the dialyser it can be obtained dissolved in pure water, and may be used instead of tannin, or oak bark, for converting skins into leather. If it be fused with an excess of soda, it is converted into the well-known soluble or water glass. This, when acidified by hydrochloric acid, is decomposed, the acid unites with the soda to constitute common salt, whilst the silica remains dissolved. If this mixed solution be dialysed, the salt passes through, and a pure solution of silica in water remains behind. Thus, solutions containing three per cent. of silica may be formed as limpid as water, with a feebly acid reaction on test-paper,

but insipid to the taste. In this later character the solution resembles many colloid bodies which seem not to have sufficient diffusive power to pass through the membrane covering the tongue in order to reach the nerves of taste. After having been made some days, the solution of silica assumes the consistence of glycerine, and afterwards gelatinizes, silica eventually separating in a solid insoluble form. The solution has a peculiar action upon gelatinous substances, such as skins, being absorbed by them, and converting them into a kind of leather, so that it is possible that flint may eventually become a cheap substitute for oak-bark in the process of tanning. On the addition of any carbonate, as chalk or limestone, the silica is caused to solidify in its substance in a hard flint-like form, and offers the possibility of converting soft and perishable limestone, by artificial means, into a hard and enduring siliceous stone.

Again, peroxide of iron may be dissolved in hydrochloric acid, thus constituting the perchloride of iron. This has the power of dissolving a large excess of the peroxide of iron. If this solution of the peroxide in the perchloride of iron be dialised, the chloride passes through, leaving the pure oxide dissolved in water in a colloid state. This also can be rendered gelatinous in the same manner as silica.

Prussian blue, insoluble in water, is perfectly soluble with oxalic acid, and if this solution be dialised, the oxalic acid passes away, and a solution of pure Prussian blue remains. This may be gelatinised by the addition of a little dilute sulphuric acid and by many other re-agents.

After having enumerated these examples, it is scarcely required to indicate the probable practical value of the process. It will certainly be employed to prepare solutions of many colloid dyeing materials, which will afterwards be caused to precipitate on the cloth, and so be capable of being used cheaply, and without a mordant. As a means of separating many mixtures, its use is obvious. It is probable that many valuable crystalized ingredients that now require for their preparation expensive and troublesome operations, may be separated from the crude mass of vegetable tissues with which they are associated naturally, by the inexpensive process of dialysis.

In fact, in all those arts which act by purifying, by refining, by separating different ingredients, and in those which like dyeing, require the employment, in a soluble state, of substances which are usually insoluble, we cannot discern a limit to the practical application of this new operation.

ARTESIAN WELLS.*

By G. R. Burnell, C. E., F. G. S.

The next important artesian borings executed of late years in chronological order, were those undertaken under the superintendance of the French military authorities in the Desert of Sahara, avowedly for the purpose of forming stations for the caravans trading between Algeria and Central Africa. They were executed by means of tools made by Messrs. Degoussee and Laurent, who seem also to have occasionally acted as consulting engineers, but the works were actually performed by the soldiers, or the labourers employed by the "Corps du Genie Militaire." It appears that up to the month of June, 1860, no less than 50 of these wells had been sunk in the desert, and that they pour upon its thirsty surface no less than 7,920,000 gallons of water per day. Similar works were, according to Aime Bey, executed in the deserts of Ancient Egypt, as was before alluded to, and there are good reasons for believing that the system of artesian borings might advantageously be applied in the deserts of north-western India, and of Australia.

Some interesting artesian wells and borings have also been executed in various parts of England and of the continent, to a few of which I propose to return hereafter, but in the meantime, I pass to the description of the great work lately completed at Passy, as being the one which has attracted the most universal attention. When the great works of the Bois de Boulogne were commenced, it was soon discovered that pumps of Chaillot would not be able to furnish the quantity of water required for the lakes and waterfalls of the new park, and the Municipal Council of Paris, encouraged no doubt by the commercial results of the previous operation at Grenelle (which had eventually cost the sum of £14,000, and had repaid its cost several times over), resolved to execute a second boring to the lower green sand, in order to secure an independent supply. It was originally proposed to execute this well of the same dimensions as that at Grenelle, that is to say, to finish with an eight-inch bore; but before it was commenced, M. Kind, a German engineer, (who had already carried out some very important works upon a system, and by the aid of tools patented by himself,) offered to contract for the new well to finish with a bore of 2 ft. in diameter, and to deliver the water at 92 ft. above the level of the ground, at the rate of nearly 3 million gallons per day. He undertook to complete the work for the sum of £14,000 within the space of two years. After some opposition, based principally on the doubts expressed by engineers, who had been consulted on the subject, with respect to the increased delivery over that of the well of Grenelle, this offer of M. Kind's was accepted, and on the 23rd December, 1854, the vote of the Municipal Council in favour of the contract with him was passed. The work was commenced shortly afterwards, and by the 31st of May, 1857, the boring had already reached the depth of 1,732 feet from the surface, when suddenly the upper portion of the tube lining collapsed, at a distance of about 100 feet from the surface, and choked up the bore-hole. This accident delayed the completion of the work for three years, and led to the rescinding of the contract with M. Kind; but the engineers of the city of Paris were so satisfied with his zeal and ability, that they confided to him the conduct of the remaining works. A new well was sunk to a depth of 175 feet 4 inches, and the boring was then cleaned out and resumed. Much trouble was encountered in traversing the strata below the distance of 1,732 feet above quoted, and at length, at the distance of about 1,894 feet from the surface, the first water bearing stratum was met with, but the water, after several oscillations did not rise to the level of the ground. The boring was continued below this level, until, on the 24th September, 1861,

*Abbreviated from the Journal of the Society of Arts.

at midday, at the depth of 1,923 feet 8 inches, the true artesian spring was tapped. When this spring rose to the surface, it discharged at the rate of 5,582,000 gallons per day. The yield has since then oscilliated, but so long as the column had not been raised above the level of the ground, the total quantity does not seem to have fallen short of 4,465,600 gallons. The well of Grenelle, (which by the way had been falling off in its yield for some time before the completion of the Passy boring, no doubt on account of some obstruction in its ascensional tube, but which for several days before the 24th September discharged regularly 200,000 gallons per day) fell, in about 30 hours after the Passy spring hadbeen tapped, to a yield of about 173,000 gallons, at which rate it remained stationary, until the tube of the Passy boring was raised so as to allow the water to stand at the same height in the two wells, when the original rate of delivery of the Grenelle well was resumed, but the rate of delivery of the Passy well fell to two million gallons per day. It is intended eventually to cause the column of water of Passy to rise to a height of 1,977 feet above the bottom of the boring, or about 54 feet above the surface of the ground. The horizontal distance of the Passy well from the one at Grenelle is about 3,830 yards; and it will be observed from the section on the wall, that the water-bearing stratum is nearly 100 feet nearer the mean level of the sea at Grenelle than it is at Passy, whilst the surface of the ground is about 35 feet higher at the latter locality than it is at the former one.

Unquestionably the effect produced upon the respective sources of supply, by the alteration in the heights of the columns of water, proves that the wells of Passy and of Grenelle are fed from the same stratum; and there can be no reason, therefore, to suppose that, when the Passy spring shall have cleared its water passages there should be any difference in the qualities of the waters at the two places. M. Peligot has carefully analysed the Grenelle waters, and he found that they contained 0·000142 of saline matters, composed principally of the carbonates of lime, potash, and magnesia, associated with a compound of sulphur, and of soda of variable proportions and conditions, and with the carbonate of the protoxide of iron and silica. The salts of the sulphate of lime, or of the more permanently insoluble description are absent, and it would appear that the gases diffused through the water are of considerable volume, the carbonic acid gas being one of the most so. There is a sensible evolution of sulphuretted hydrogen from both the wells of Passy and of Grenelle, and it is worthy of remark that the same gas is given off from the water in Mr. Gatehouse's well at Chichester, though in the latter instance the smell is sufficiently strong to render the water positively repulsive. At the present day the water at Passy is still foul, on account of the matters it brings up in suspension; but, as in the case of the Grenelle well, this inconvenience will no doubt soon disappear. The temperature at which it reaches the surface is identical in the two wells, and is about 82° Fahrenheit.

It may be worth while to call attention to the mechanical means adopted by M. Kind in sinking a boring of the large diameter of 2 feet 4 inches, to the enormous depth of nearly 2,000 feet from the surface. The work was commenced by a shaft, as usually is the case, and after it had been sunk to a depth of about 50 feet, the boring commenced, and was continued with as nearly as possible the same diameter to the bottom. M. Kind employed for this purpose what may be called rods with releasing joints, very closely resembling the joints introduced by Œuyenhausen, which allowed the cutting portion of the tool to be raised a certain height, and then to be released automatically; this arrangement was adopted in order to avoid the lashing of the sides of the bore by the long rods, and to regulate the force of the blow. The cutting tool used by M. Kind also differed from the tools generally employed, for it consisted of a single or a double trepan, according to the nature of the ground, instead of the ordinary chisels and augurs. A patent was taken out for these tools by M. Kind, No. 13,478, of the year 1854, the printed specification of which contains a series of engravings of the various modifications proposed for the various kinds of rocks; in the *Annuaire Scientifique* for 1861, illustrations will also be found of the ordinary trepans and of the slide joints. M. Kind is able, by these combinations, to strike as many as twenty blows in a minute with the greatest regularity at a depth of 2,000 feet. The patent of 1854 specifies also certain methods of lining the sides of the borings; but it must be confessed that they do not seem to me to possess any great merit, and indeed M. Kind had more difficulties to encounter at Passy from the collapsing of his tubes, than from any other cause. It is a common error of well borers to undervalue the effort exerted by clays swelling when charged with water; and the great delays encountered in sinking the Passy well were precisely caused by the false economy introduced in the execution of the tube linings. The time actually employed in sinking the Passy well was nearly the same as that employed at Grenelle; in the former instance it was 6 years 275 days, in the latter it was 7 years 90 days. The cost of the Grenelle well, as above stated, was £14,000; that of the well at Passy was £40,000, but it must be observed that the quantity of water, delivered at the same height in the two cases, is ten times greater at Passy than it is at Grenelle; the rates of delivery are, in fact, nearly in the direct ratios of the diameters.

Miscellaneous.

ILLUMINATING GAS FROM PETROLEUM.

The following circular speaks for itself. We may soon hope to see an abundant use for the Canadian petroleum.

109 King Street West, Toronto,
April 3, 1862.

Sir,—We beg to inform you that we have secured a patent in Canada for the manufacture of Illuminating Gas from Crude Petroleum.

Our process is susceptible of being applied on any scale, from the lighting of a dwelling house to that of the largest city.

Three materials are employed in the manufacture of our Illuminating Gas. These are, Crude Petrole-

um, Water and Charcoal or Coke, all of them accessible and cheap, and from the extraordinary abundance of Petroleum in Canada and the United States, this body is likely to remain so.

The qualities which we confidently expect will secure for Petroleum Gas your favour, are—

1st. *Its extraordinary illuminating power.*

2nd. *The mildness and softness of its light.*

3rd. *Its cheapness.*

4th. *The ease with which a supply can always be controlled for illuminating, heating, or cooking purposes.*

A ONE foot burner gives a flame as large as a FOUR foot burner of the common coal gas supplied to cities and towns. The comparative smallness of the flame greatly diminishes the heat, which is often found so oppressive in large rooms lighted with coal gas. The absence of the flickering, which is often disadvantageous and disagreeable in common coal gas, is another quality which it can be made to possess. Until the recent adoption by the public of coal and petroleum oil lamps, coal gas was considered to be by far the cheapest illuminator known. Since the discovery of a process for manufacturing gas from petroleum, to burn without smoke or smell from ordinary gas burners when properly made, coal gas has been far surpassed in cheapness by petroleum gas, and a milder, steadier, yet stronger light secured.

Its cheapness may be inferred fron the following brief statement:—

Five gallons of crude petroleum distilled and converted into gas according to our process, make one thousand cubic feet of gas. But one cubic foot of the petroleum gas is equal in illuminating power to *four* cubic feet of common coal gas, so that in effect five gallons of petroleum are capable of producing an amount of light represented by 4,000 cubic feet of coal gas, or from $12 to $16 in money, according to the present ratio of gas charges in Canada. Where gas is required to be manufactured on a large scale, it is desirable to remember that petroleum and water are easily handled, and can by their own flow supply the retorts continuously and without waste, thus doing away with the unceasing labour of continually replenishing the retorts with coal, and the expense entailed in the maintenance of numerous hands.

With respect to public buildings, one man giving three hours' attention per day to the manufacture of petroleum gas, can produce by our patent process, enough gas to supply 100 burners with full pressure for ten hours, at a cost of material not exceeding ONE DOLLAR, fuel for distillation included, or at from one-fourth to one-third the cost usually charged by the gas companies now existing in Canada.

The substitution of petroleum for coal in gas works now in operation, can be effected with very little additional expense.

In public and private buildings where it is desirable to introduce petroleum gas, a detached room would be required, according to the capacity of the works. The pipes and burners now used by gas companies are in all respects adapted to the petroleum gas, with this difference, that where a FOUR foot burner (the one in common use) for coal gas is employed, a ONE foot burner for petroleum gas would have to be substituted. Petroleum gas burning through a FOUR foot coal gas burner is a magnificent illuminator, and one which would not often be used for ordinary purposes.

Any communications relative to the introduction of the Patented Petroleum Gas into public buildings or private houses, may now be addressed to James E. Thompson, 109 King Street West, Toronto; and if the applicant state the number of burners required to be supplied, an estimate of the size and cost of the apparatus will be returned without delay.

We are Sir,
Your obedient servants,
JAS. E. THOMSON,
Hydraulic & Gas Engineer.
HENRY YOULE HIND, M.A.,
Prof. of Chem. & Geol. Trin. Coll., Toronto.

CAUTION TO THE PUBLIC.

The public are respectfully informed that Messrs. James E. Thompson and H. Y. Hind, have secured patents for—

First. An *apparatus* for the manufacture of Illuminating Gas from Crude Petroleum or Rock Oil.

Second. A *process* for the manufacture of Illuminating Gas from Crude Petroleum or Rock Oil.

And they claim—

1st. "The invention of a portable or stationary iron or clay Compound Retort for the simultaneous production of gases from petroleum and water, by means of which retort a useful, rich, and economical illuminating gas can be obtained."

2nd. "The simultaneous production within the same Compound Retort, of gases from crude petroleum and water, or in a different and separate retort, if the gases are subsequently brought together at a red heat, to effect the requisite combinations; also the purification and deodorizing of the gases by means of dilute hydrochloric acid, or other suitable acids, so as to fit the gases for combustion under ordinary circumstances."

The Patentees will take legal proceedings against parties infringing their patented rights.

Charcoal as a Disinfectant.

Dry charcoal, in the presence of atmospheric air, is a powerful means of destroying the mephitic gases and vapours of sewers and house drains. Charcoal filters may be used with efficacy in the course of the air channels from the drains and closets of houses, as well as in the ventilation of the public sewers; in applying the charcoal, those contrivances should be used which offer the least resistance to the free passage of the air; the situation of the filters is best when the charcoal is protected from wet and from dirt, and is easily accessible; and from the ascertained efficacy of charcoal in destroying the dangerous emanations from sewers, the system may be generally applied with great advantage.

There were two varieties of mechanical arrangements adopted for applying the charcoal in the late experiments instituted in London (England); one was that patented by Messrs. Bean and Burge, which consisted of one large seive with compartments, the other was an adaptation of our own, and consisted of a series of trays for holding the charcoal, and were so constructed as to be capable of being readily removed from the frames into which they fitted.

Wood charcoal was employed, broken into pieces of the size of a filbert. It was packed closely, but without compression, upon the various trays; and each tray held about $1\frac{1}{12}$ lbs. of charcoal, making altogether $6\frac{1}{2}$ lbs., distributed over the six trays of each air filter.

The charcoal appears to lose much of its power when saturated with water; and as the position in

which the trays containing it are placed is such that leakage of water into them in times of rain is, to some extent, all but impossible; and as, moreover, the atmosphere of the sewers is always very moist, the charcoal becomes so wet as to require removal before it has failed as a deodoriser. Upon an average the sieves have been recharged about once in three months. Those which have been in very wet situations have been re-filled much more frequently, and those in dry situations less.

Commerce of Montreal.

The number and tonnage of vessels entered inwards at the port of Montreal, up to the 21st November in each year for the last ten years, show the following figures:

	No. of Vessels.	*Tonnage.*
1852	191	45,802
1853	242	58,894
1854	275	72,305
1855	197	47,904
1856	230	69,777
1857	208	65,330
1858	191	70,183
1859	191	85,193
1860	240	118,216
1861	498	247,247

The enormous increase in the tonnage in 1861 shows how exceedingly prosperous has been the trade in 1861 as compared with that of former seasons.

Steam Boiler Explosions Prevented.

A correspondent of the *Mining Journal* says:—As any proposition for the prevention of loss of life unnecessarily is worthy of consideration, it may be interesting to know that Ericsson's caloric engine is now in use in 500 practical instances in the United States, the purposes to which it is applied being almost equally varied—this source of motion having been adopted for making matches and for draining mines, for making hooped skirts, for picking hair, for irrigation, and for supplying villages with water, as well as for quartz crushing, grinding coffee, and numerous other purposes. The manufacturers of Ericsson's engine claim that by the use of hot air engines steam boiler explosions would be effectually prevented, and that there are few forms of labour employing steam in which this inexplosive and safe motor, Ericsson's caloric engine, might not be advantageously employed.

Geoffrey St. Hilaire.

Late news from Europe contains intelligence of the decease of this renowned zoologist, in Paris, on the 9th ult. He was born in 1805, and was therefore 56 years of age at his death. He was the son of E. Geoffrey the celebrated French anatomist, and was a prodigy of scientific learning at 19 years of age. He was a professor of th e natural sciences and published several works on anatomy and physiology, which have won for him a high position among the great names of the earth. He was one of those cool, utilitarian French philosophers , and was the first to advocate the use of horse-flesh for human food in France.

Gases given off by plants under the influence of Light.

M. Boussingault has discovered (*Comptes-Rendus*, t. liii., p. 862) that under the influence of direct sunlight, the leaves of aquatic plants give off a notable proportion of carbonic oxide and carburetted hydrogen. He thinks that this emanation of carbonic oxide may be one of the causes of the unhealthiness of marshy districts. The fact he points out is important, and the subject will, no doubt, receive further investigation.

Photographic Ware Baths.

We find continual allusion and constant praise given in the American journal to a new material for baths. "At presnt" observes a writer in *Humphrey's Journal*, "probably, the most popular bath is known as the photographic ware, an invention of George Mathiot, an electrotypest, of Washington. The invention grew out of a want in Mr. Mathiot's business, viz., a cheap ware which will hold acid solutions, and consists simply in soaking the vessels of unglazed and porous porcelain in melted wax. Thus Mr. Mathiot killed two birds with one stone, and did a very handsome thing for photography as well as for electrotype. Such ware costs but a trifle, is neat, handy, and durable. Would not paraffin be a useful substitute for the wax? There is no compound known which is so little effected by corrosive matters."—*Mech. Mag.*

Port Dover Woollen Factory.

The Woollen Factory at Port Dover has been completed, and the works were opened on Friday, 7th February. The mill is nearly 300 feet long, and four stories in height. Its machinery is driven by a head of water of about 13 feet. The machinery for carding, spinning, weaving, and dressing, is of very superior description, and all details appear to have been attended to with judgment and practical skill. A description of this establishment will be found in the last No. of the Journal.

International Cattle Show, 1862.

The Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland, have jointly arranged to conduct an International Cattle Show in London next summer, and Battersea-park has been granted for the purpose, where the necessary enclosure and buildings will be made. The show will take place during the week commencing the 23rd of June, 1862. The prizes offered by the Royal Agricultural Society, consist of money and medals.

The Ordeal Root.

At a recent meeting of the Pharmaceutical Society, Professor Bentley exhibited a specimen of the Ordeal Root spoken of by M. du Chaillu in his book on Western Africa. It is there said to be in use among some African tribes as a test for witchcraft—an individual suspected of that crime being required to imbibe a strong infusion of the root. It is intensely poisonous, and if the individual dies he is supposed to have been guilty, but if, from any cause, he should survive the ordeal, he is considered innocent. The observed effects of the poison, and the character of the bark on the root, the Professor said, left no doubt on his mind that it was derived from a species of strychnos.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

MAY, 1862.

THE INTERNATIONAL EXHIBITION.

From the *London Mechanics' Magazine* of the 9th of May, we copy the following extracts relating to the Western Annexe, or Machinery Department, of the International Exhibition. This is the first of a series of articles we shall from time to time publish from this and other similar journals, which we doubt not will be of great interest to our machinists and practical men, and may be the means of inducing some amongst them—who might otherwise have been indifferent to the subject—to put forth all their energies and skill to make a suitable display in the corresponding department of our own Provincial Exhibition, to be held in this City in September next.

" The Western Annexe is undoubtedly the point of attraction to mechanical men. It is impossible, indeed, for any one who has been ascustomed to the music of machinery in motion to pass along what Mr. Robert Hunt designates ' the fine perspective arcades' of the Western Annexe without being himself moved. The amount of thought and labour (to say nothing of money) which have been expended in preparing that show can be fully appreciated by those alone who have been engaged in the fitting up of engines and machinery, and who are conversant with the duties of the drawing office, the pattern shop, the foundry, and the erecting department. There is not a point of minutest detail in the whole of the varied and ingenious mechanical appliances which fill the Western Annexe which has not demanded careful calculation, and the exertion of great practical skill. The curious may find an ample field for study in the peculiarities of workmanship exhibited in the machinery and tools of different manufacturers; little crotchets and quirks reveal themselves to the close observer which by the general looker-on are unnoticed. Indeed, some makers of machinery, although ever engaged in devising machines for accomplishing new purposes, or superseding hand labour, yet have their individualities so strongly stamped on their productions, that it needs no brass plate nor ' spirit from the grave' to tell us whence those productions came. As the botanist does not fail to decide to what family or genus a plant belongs by an examination of its petals or its stamens, so does the initiated mechanist at once declare from whose factory came the engine, the planing machine, or the steam hammer which may be brought under his notice. We have long been aware of this mechanical idiosyncrasy, so to speak, but the idea was strengthened by our examination of the thousand and one specimens of engines and engineers' tools which fill the Western Annexe.

" The steam-power which gives motion to the whole of these—or at least to those which are intended to be put in motion—is derived from a nest of boilers placed in a boiler house beyond the Annexe, and in the rear of the conservatory of the Horticultural Gardens. The arrangement and the construction of the boilers somewhat pleased us, and it may be well to give a few particulars in reference to them. There are in the whole six boilers; these are cylindrical, and of the high pressure kind. They are each thirty feet in length, six feet six inches in diameter, and they all have double fire-places within their flues.

"Ranged side by side, horizontally, at convenient distances from each other, and placed high enough and not too high for the stoker's convenience, they form a model of good boiler setting. There are no abominable stoke-holes, the temperature and dust of which stifle and choke their unhappy occupants, but all is above ground and accessible. Messrs. Hick, of Bolton, were the makers of the Exhibition boilers, and they have no reason to be ashamed of their work. So extensive is the demand made upon the steam mains —two of which traverse longtitudinally each of the ' fine perspective arcades' of the Annexe, in trenches made for their reception—so great is the demand made upon these for keeping the machinery moving, that the whole of the boilers have to be in use at the same time, and a pressure of not less than 70 lbs. on the square inch maintained.

" Smoke-consuming fire-doors are attached to the furnaces of the boilers, but these, we believe, effect but partially the object sought. The flues communicate with a chimney of large diameter, but of low elevation at the back of the boiler-house,. and the whole of the building containing the boilers with the chimney itself were completed, under the superintendance of Mr. Jacobs, in the short space of nineteen days.

" This, then, is the source of power for moving the masses of machinery within the Annexe, and it would have been unwise to have omitted describing it. Of course, from the main steam arteries, in their subterranean but easily accessible beds, branch veins diverge to, and connect them with, the various engines to be put in motion, and these branches again are fitted with stop-valves, under control of the respective attendants.

" It was our intention to have spoken, in the first instance, of the foreign machinery in the Western Annexe, for it would be far more gracious and graceful to do so than to bepraise our own inordinately, and have no words of kindness for the inventions of our neighbours. It is a fact, however, that much remains to be done to make the foreign mechanical branch complete, and possibly it may be well to defer remarking thereon until it be so. There are some excellent tools displayed by Zimmerman, of Chemnitz, Saxony. These are put in motion by two or three lines of light shafting, supported on columns, and fitted with drums and straps, and each machine has its price affixed. From the excellence of the workmanship about these contrivances, which, generally, are for the fitments of an engineer's shop, and their low price, we much question whether our English toolmakers will not find it difficult to compete with the Chemnitz work.

"Near to Zimmerman's allotted space a locomotive of excellent construction is to be seen, and this is the work of Hartmann, also a Saxon, and located at Chemnitz. Opposite to these are portable sawing machines, invaluable to the emigrant in a wooded colony, and these are from Paris, as are some cranes in close proximity to the sawing machines.

"The classification of machinery in this part of the Exhibition is well calculated for the purposes of instruction to mechanical students, and, naturally marine engines stand at the head of the list. For compactness and neat arrangement of parts, the palm must be yielded to Humphry's and Tennant's specimens, by whom engines were supplied to the British, the Brazillian, and other Governments. This firm have evidently studied with success two of the most important points in connection with engines for war steamers and screw propulsion; they have compressed the greatest amount of power into the least possible compass, and contrived so that they shall be placed out of harm's way in the depths of the hold. The pair of 400 H.P. engines by Maudslay, sons, & Field, for H.M.S. Valiant, again, is another proof of the talent of the eminent firm in question. We believe that the Messrs. Maudslay had not the slightest idea, up to within a short time of the opening of the International Exhibition, that these engines were to be placed within it. They were being prepared for the ship for which they were intended, and by no means got up for a show at Kensington, Whatever of merit, therefore, may pertain to the workmanship of the Valiant's engines, is the genuine and legitimate result of Messrs. Maudslay's usual excellence in this branch.

"Todd and MacGregor's direct acting inverted cylinder marine engines have many striking and excellent points about them, as well as some of a peculiar character. Of the last description, is that arrangement by which the two cylinders are made to work vertically over the crank shaft. This firm is remarkable for the general finish and beauty of the work leaving its hands, and the pair of engines now referred to constitute a gem in these respects.

Messrs. George Rennie & Sons, of London and Greenwich, exhibit a pair of marine screw engines for H. M. S. Reindeer. These are of 200 H.P. nominal, and are precisely similar to those of H. M. S. Perseus, a sister vessel. They may be denominated single trunk engines, and for compactness of arrangement rival any in the Exhibition. The projecting trunk, objected to by many, is absent in Rennie's engines, while they have the advantage of a long connecting rod, which one misses in those of Humphrys and Tennant, before referred to. The cylinders are placed close to the condensers, and thus a good vacuum is likely to be ensured. The bottom bearing of the connecting rod, too, is easy of access—a practical point, which those who are acquainted with the working of marine engines will know how to appreciate. The slide valves are double ported, and the pressure of steam at the back is relieved by an arrangement first introduced into marine engines by Messrs. Rennie. These engines are simple in construction, and at the same time possess great strength. They are, therefore, apparently well calculated for the hard work contingent on constant steaming in long voyages. Similar engines are in actual use, we believe, in H. M. Navy, as well as in those of the Russian, Mexican, Chilian, and Italian governments. The only war steamer as yet possessed by the British colonies—the Australian steamer Victoria—has a pair of similar engines. The same firm are engaged in the construction of a large pair of engines for the Peninsular and Oriental Company. These are on the combined, or high and low pressure principle, and are to have a superheating apparatus and boilers on Lamb's patent plan. It is unfortunate that these engines, which combine the very latest improvements in marine engineeriug, are not in the Exhibition.

"One of the great objects of this display is to lead us on to suggestions of a practical nature, and which may tend to the public advantage. If the courts and aisles of the palace of industry and art, with their rich and varied contents, are to be regarded only as a show, why then there is little use in their having been prepared at all, and the money and labour lavished in furnishing them had better have been expended in some other way.

"Next in order of disposition in the Western Annexe are to be found machine tools of every kind, and wood-working machinery of very ingenious construction. Perhaps, in the first rank of tool-makers may be placed Whitworth, of Manchester, and in that of machinery for performing operations upon wood for building and other purposes, Worssam, of Chelsea. The ingenuity displayed in the construction of machines for morticing, turning, planing, and dressing wood generally, is, indeed, something marvellous. It is true that Bentham and Brunel were the pioneers in this direction, but it is equally true that they have not found many followers until Mr. Worssam stepped into the field, and, no doubt, he will "marshal others in the way that they should go." The machines for dealing with metals in the Exhibition represent most fairly and completely those employed in the engineering establishments of the United Kingdom, and they undoubtedly display an amazing amount of ingenuity.

"If such men as Smeaton and Rennie, and others of the same school, could only look into a modern engineer's shop, they would, indeed, be astonished at the progress which has been made since their day in the tool department. The hammer, the chisel, and the file constituted the main appliances for carrying on work when they flourished, but now we have changed all that, and machines are made which do all but think and speak, and that, perhaps, *is* beyond their capabilities. Cotton spinning machinery of the most exquisite delicacy figures largely in the Western Annexe; while, by way of contrast, we have sugar mill work of the most massive description. All alike testify to the skill of the artizans of Britain, and demonstrate that nothing is too minute, nothing too ponderous to be dealt with, and successfully dealt with, by them. Where so many exhibitors have excelled, it seems almost invidious to particularise, and the feeling engendered by a view of the machinery in the Western Annexe is simply one of pride, strongly mingled with admiration. The rapid strides made in mechanical science since this magazine came into being—now some forty years since—is immense. What would a "western annexe" have

been filled with in 1820, for example? And what an interesting thing would it not be if it were possible to establish a department in the Exhibition in which the steam engines, machines, tools, and general mechanical appliances of that time could be shown by way of contrast with the present magnificent display! Then, again, if a road waggon, a stage-coach, and a locomotive, were placed side by side, how eloquently would they not speak of progress and improvement! It is, perhaps, a misfortune as regards the International Exhibition, that none of these startling comparisons were tangibly instituted. They are more instructive to young minds than any other mode of inculcating knowledge. If Stephenson's "Rocket" were placed beside the locomotive of Sharp, Stewart & Co., or that of the North Western Railway Company, or of Sir William Armstrong, how unmistakably would it tell of what thirty odd years of railways have done for us, in a mechanical sense! Such were some of the reflections which passed through our mind while going through the "fine perspective arcades" of Mr. Hunt, and gazing on the mechanical treasures stored within them. It is possible that some day the suggestions we venture to throw out with regard to *Comparative Exhibitions of Mechanical Science*, may be realised. When this season shall have passed away, and the vast building which has challenged and obtained so much hostile criticism shall remain as a casket whence the jewels have been abstracted, it may come to be a consideration as to how it may thereafter be employed, and then may comparative schools be opened therein.

"Occupying a very small space in the Western Annexe are some machines which are the precursors of a revolution in one extensive branch of tool manufacturing, and these are the file-cutting machines of the Manchester File Making Company. It has been maintained obstinately for many years past that the manufacture of files was beyond the machinist's art. Hand labour alone could produce them, it was said, and in Sheffield it was stoutly declared that hand labour alone SHOULD produce files. At length the problem seems to be solved—the delusion dissipated; and from what we see of the file-cutting machines in the Exhibition, and know of their performances in Manchester, we are bold to say that the days of hand file-cutting are numbered. The importance of this change can scarcely be over-estimated, as the price of files will be reduced enormously by it. The Sheffield workers will have to succumb to the giant might of automatic machinery, as other classes of workers have been compelled to do, and the sooner they accept the alteration of system the better will it be for themselves.

"We have left ourselves little space to touch a hundred other topics which crowd upon our attention and claim notices at our hands. It is embarrassing thus to find so rich a mine of mechanical wealth as the Exhibition affords, and not be able to work it at once more effectually; but again and again shall we return to the task, nor leave it until justice has been done to those who have created it."

The largest steam whistle in the world is said to be the one at the Rolling Mills, Toronto. The bell of the whistle is 14 in. diameter.—*Artizan.*

PROGRESS OF GEOLOGY.

(*Continued from page* 103.)

Geological Survey and Government School of Mines, Mineral Statistics and Colonial Surveys.—As I preside for the first time over this Section since I was placed at the head of the Geological Survey of Britain, I may be excused for making an allusion to that national establishment, by stating that the public now take a lively interest in it, as proved by a largely increased demand for our maps and their illustrations—a demand which will, I doubt not, be much augmented by the translation at an early day of many of our field-surveyors from the southeastern and central parts of England, where they are now chiefly employed, to those northern districts where they will be instrumental in developing the superior mineral wealth of the region.

The Government School of Mines, an off-shoot of the Geological Survey, is primarily intended to furnish miners, metallurgists, and geological surveyors with the scientific training necessary for the successful pursuit and progressive advancement of the callings which they respectively pursue: but at the same time, the lectures and the laboratories are open to all those who seek instruction in physical science for its own sake, by reason of its important application to manufactures and the arts. The experience of ten years has led the Professors to introduce various modifications into their original programme—with the views adapting the school as closely as possible to the wants of those two classes of students; and at present, while a definite curriculum, with special rewards for excellence is provided for those who desire to become mining, metallurgical and geological associates of the school, every student who attends *a single course of lectures* may by the new rules compete, in the final examination, for the prizes which attach to it only.

Throughout the whole period of the existence of the school, the Professors have, as a part of their regular duty, given annual courses of evening lectures to working-men, which are always fully attended; and during the past year several of them have delivered voluntarily courses of evening lectures, at a fee so small as to put them within the reach of working men, teachers and schoolmasters of primary schools. The Professors thus hope to support to the utmost the great impulse towards the diffusion of a knowledge of physical science through all classes of the community, which has been given through the Department of Science and Art by the Minute of the Committee of Privy Council of the 2nd June, 1859. * * *

As I can trace no record of the teachings of the Government School of Mines in the volumes of the British Association, and as I am convinced that the establishment only requires to be more widely known, in order to extend sound physical knowledge not merely to miners and geologists, but also to chemists, metallurgists, and naturalists, I have only to remind my audience that this School of Mines which, owing its origin to Sir Henry De la Beche, has furnished our Colonies with some of the most accomplished geological and mining surveyors, and many a manufacturer at home with good chemists and metallurgists, has now for its

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* Am. Jour. Sci.—Second Series, Vol. XXXIII, No. 97.—Jan. 1862.

lecturers men of such eminence, that the names of Hoffman, Percy, Warrington Smyth, Willis, Ramsay, Huxley, and Tyndall are alone an earnest of our future success.

In terminating these few allusions to the Geological Survey, and its applications, I gladly sieze the opportunity of recording that in the days of our founder, Sir Henry De la Beche, our institution was greatly benefitted in possessing, for some years, as one of its leading surveyors, such an accomplished naturalist and skilful geologist, as the beloved Assistant General Secretary of the British Association, Professor Phillips, who by his labors threw much new light on the palæontology of Devonshire, who, in the Memoirs of the Survey, has contributed an admirable Monograph on the Silurian and other rocks around the Malvern Hills and who, by his lectures and writings, is now constantly advancing geological science in the oldest of our British Universities.

There is yet one subject connected with the Geological Survey to which I must also call your attention, viz., the Mineral Statistics of the United Kingdom, as compiled with great care and abilty by Mr. Robert Hunt, the Keeper of the Mining Records, and published annually in the Memoirs of our establishment.

These returns nade a deep impression on the statists of foreign countries who were assembled last year in London at the International Congress. The Government and members of the legislature are now regularly furnished with reliable information as to our mineral produce, which, until very recently, was not obtainable. By the labors of Mr. Robert Hunt, in sedulously collecting data from all quarters, we now become aware of the fact that we are consuming and exporting about 80 millions of tons of Coals annually (a prodigious recent increase, and daily augmenting). Of Iron-ore we raise and smelt upwards of 8 millions of tons, producing 3,826,000 tons of pig iron. Of Copper-ore we raise from our own mines 236,696 tons, which yield 15,968 tons of metallic copper; and from our native metallic minerals we obtain of Tin 6,695 tons; of Lead, 63,525 tons; and of Zinc, 4,357 tons. The total annual value of our Minerals and Coals is estimated at £26,993,573, and that of Metals (the produce of the above minerals) and Coals at £37,121,318 !

When we turn from the consideration of the home survey to that of the Geological Surveys in the numerous colonies of Great Britain, I may well reflect with pleasure on the fact that nearly all the leaders of the latter have been connected with, or have gone out from, our home Geological Survey and the Government School of Mines.

Such were the relations to us of Sir William Logan in Canada; of Professor Oldham in India, with several of his assistants; of Selwyn in Victoria; of my young friend Gould in Tasmania, as well as of Wall in Trinidad; whilst Barrett, in Jamaica, is a worthy pupil of Professor Sedgwick. Passing over the many interesting results which have arisen out of the examination of these distant lands, we cannot but be struck with the fact, that whilst Hindostan (with the exception of the Higher Himalayan mountains) differs so materially in its structure and fossil contents from Europe, Australia (particularly Victoria) presents, in its Palæozoic rocks at least, a close analogy to Britain. Thanks to the ability and zeal of Mr. Selwyn, a large portion of this great auriferous colony has been already surveyed and mapped out in the clearest manner. In doing this he has demonstrated that the productive quartzose veinstones, which are the chief matrix of gold, are merely subordinate to the Lower Silurian slaty rocks, charged with Trilobites and Graptolites, and penetrated by granite, syenite, and volcanic rocks,—occupying vast regions. * Mr. Selwyn, aided in the palæontology of his large subject by Prof. M'Coy, has also shown how these original auriferous rocks have been worn down at successive periods, one of which abrasions is of Pliocene age, another of Post-Pliocene, and a third the result of existing causes. All these distinctions, as well as the demarkation of the Carboniferous, Oolitic, and other rocks, are clearly set forth. Looking with admiration at the execution of these geological maps, it was with exceeding pain I learnt that some members of the Legislature of Victoria had threatened to curtail their cost, if not to stop their production. As such ill-timed economy would occasion serious regret among all men of science, and would, I know, be also deeply lamented by the enlightened Governor, Sir Henry Barkley, it would at the same time be of lasting disservice to the material advancement of knowledge among the mining classes of the State, let us earnestly hope that the young House of Parliament, at Melbourne, may not be led to enact such a measure.

Whilst upon the great subject of Australian geology, I cannot avoid touching on a *quæstio vexata* which has arisen in respect to the age of the coalfields of that vast mass of land. Judging by the fossil plants from some of the carboniferous deposits of Victoria, Prof. M'Coy has considered these coaly deposits to be of the Oolitic or Jurassic age, while the experienced geologist of New South Wales, the Rev. W. B. Clarke, seeing that where he has examined these deposits, some of their plants are like those of the old coal, and that the beds repose conformably upon and pass down into strata with true Mountain limestone fossils, holds the opinion that the coal is of Palæozoic age. As Mr. Clarke after citing a case where the coal-seams and plants were reached below Mountain-limestone fossils, expresses a hope that Mr. Gould may detect in Tasmania some data to aid in determining this question, I take this opportunity of stating that I will lay before this meeting a communication I have just received from Mr. Gould, in which he says that in the coal-field of the rivers Mersey and Don, one of the very few which is worked in Tasmania, he has convinced himself that the coal underlies beds containing specimens of true old Carboniferous fossils. Remarking that these relations are so far unlike those which he observed on the eastern coast of the island where the coal over-

* While this sheet is passing through the press, we are in receipt of a letter from Walter Mantell, Esq., of New Zealand, dated Auckland, Aug. 30. in which he confirms the discovery of new gold fields in New Zealand. "This discovery," he adds, "is important rather in a political than in a scientific light. In my last conversation with Sir Roderick Murchison, he declared his conviction of its existence, and now no one doubts it. By the last news, we hear of a man and a boy getting five lbs. in seven days, &c. Our natives had no metal nor any knowledge of metals despite the quantities of gold now turning up. The non-utilization of this by so observing and ingenious a race is a strange fact."—Eds.

lies, yet is conformable to, the Carboniferous limestone, he adds, that in Tasmania, at least, the coal most worked is unquestionably of Palæozoic age.

Now, as Australia is so vast a region, may not much of the coal within it be of the age assigned to it by Mr. Clarke; and yet may not Professor M'Coy be also right in assigning some of this mineral to the same Oolitic age as the coal of Brora and the eastern moorlands of Yorkshire?* In his surveys of Tasmania, Mr. Gould has also made the important discovery of a resinous shale, termed Dysodile, and which, like the Torbane mineral of Scotland, promises to be turned to great account in the production of paraffine.

There are, indeed, other grounds for believing that coal, both of the Mesozoic as well as of the old Carboniferous age may exist in Australia. Thus, putting aside the fossil evidences collected in Victoria by M'Coy and Selwyn, we learn from the researches of Mr. Frank Gregory in Western Australia, that Mesozoic fossils (probably Cretaceous and Oolitic) occur in that region; whilst the Rev. W. B. Clarke informs me in a letter just received, that he is in psssession of a group of fossils transmitted from Queensland, 700 or 800 miles north of Sydney, which he is disposed to refer to the age of the Chalk; there being among the fossils Belemnites, Pentacrinites, Pectines, Mytili, Modiol, &c. Again, the same persevering geologist has procured from New Zealand the remains of a fossil Saurian, which, he thinks, is allied to the Plesiosaurus.†

It would therefore appear that in the southern hemisphere, there is not merely a close analogy between the rocks of Palæozoic age and our own, but further, that as far as the Mesozoic formations have been developed, they also seem to be equivalents of our typical Secondary deposits.

This existence of groups of animals during the Silurian, Devonian, Carboniferous, and even in Mesozoic periods in Australia and New Zealand, similar to those which characterise these formations in Europe, is strongly in contrast with the state of nature which began to prevail in the younger Tertiary period. We know from the writings of Owen that at that time the great continent at our Antipodes was already characterised by the presence of those marsupial forms which still distinguish its *fauna* from that of any other part of the world.

* Prof. Dana in his Geology of the United States Exploring Expedition under Captain Wilkes (Philad.. 1849), expresses the conclusion as the result of his examination of the coal fields of New South Wales (in 1840) that they are either upper Carboniferous or Permian "While the coal plants point to the upper Carboniferous or still higher, the fossils below the coal seeem to correspond most perfectly with the lower Carboniferous epoch. The conformity and continuity of the series of beds, the frequent occurrence of Coniferous logs, like those of the coal beds, in the sandstone at different localities, together with the characters of the fossil fish, leave little doubt that the whole is one prolonged age, referrable to the upper Carboniferous, or partly to the lower Permian era." (Geology p. 495.) The fish referred to is a true heterocercal form, indicating according to Agassiz, the upper Carboniferous or a transition to the Permian. This fish (*Urosthenes Australis*) is figured on Plate 1, Dana's Australian Fossils, in the folio Atlas accompanying the Report. There is sufficient evidence in the forms of Mollusca figured on the following plates, of the continuation of Palæozoic types beyond their usual limits, indicating a fauna as abnormal for the early age of that most peculiar of continents as now seen in its characteristic types.—Eds.

† Whilst this is passing through the press, Professor Owen has described this interesting fossil, before this Section, as *Plesiosaurus Australis*.

In relation to our Australian colonies, I must also announce that I have recently been gratified in receiving from Messrs. Chambers & Finke, of Adelaide, a collection of the specimens collected by McDouall Stuart, in his celebrated traverse (the first one ever made) from South Australia to the watershed of North Australia. * * *

These specimens are soft, white, chalky rocks, with flints, agates, saline and ferruginous incrustations, tufas, breccias, and white quartz rocks, and a few specimens of quasi-volcanic rock, but with scarce a fragment that can be referred to the older stages of Lower Silurian age like those of Victoria.* Again, the only fossil shells collected by Mr. Stuart (though the precise latitude is unknown to me) are Mytiloid and Mya-like forms, seemingly indicating a Tertiary age, and thus we may be disposed provisionally to infer that large tracts of the low interior between East and West Australia have in very recent geological periods been occupied by the sea. * * *

* It must however, be noted that the collection sent to me consists of small specimens of rock forming an imperfect series.

Board of Arts and Manufactures
FOR UPPER CANADA.

PROCEEDINGS OF THE SUB-COMMITTEE.

At the Monthly Meeting of the Sub-Committee, held on the 24th of April, a special committee was appointed to memorialise the three branches of the Legislature to pass an Act amending the Patent Laws of this Province, so as to allow citizens of the United States, and other countries, to obtain Letters Patent in Canada on the same terms as her own citizens.

Such an amendment to our Patent Laws, by doing away with the restrictions now placed upon all but British subjects actual residents in Canada in the obtaining of patents in this Province, would enable our citizens to avail themselves of the provisions of an Act passed by the Congress of the United States, in March, 1861, section 10 of which is as follows:

"That all laws now in force fixing the rates of the Patent Office fees to be paid, and discriminating between the inhabitants of the United States and those of other countries, which shall not discriminate against the inhabitants of the United States, are hereby repealed, and in their stead the following rates are established:

"On filing each caveat, ten dollars.

"On filing each original application for a patent, except for a design, fifteen dollars.

"On issuing each original patent, twenty dollars.

"On every appeal from the examiners-in-chief to the Commissioner, twenty dollars.

"On every application for the re-issue of a patent, thirty dollars.

"On every application for the extension of a patent, fifty dollars; and fifty dollars, in addition, on the granting of every extension.

"On filing each disclaimer, ten dollars.

"For certified copies of patents and other papers, ten cents per hundred words.

"For recording every assignment, agreement, power of attorney, and other papers, of three hundred words or under, one dollar.

"For recording every assignment and other papers over three hundred and under one thousand words, two dollars.

"For recording every assignment or other writing, if over one thousand words, three dollars.

"For copies of drawings, the reasonable cost of making the same."

The valuable Library of Reference of works of a practical and useful character, is now open from 10 to 12 and from 1 to 4 o'clock each day; and on Tuesday and Friday evenings from 7 to 10 o'clock.

Admission Free to all.

W. Edwards, *Sec'ry.*

BOOKS ADDED TO THE LIBRARY OF REFERENCE DURING THE MONTH.

CLASS V.

Official Catalogue of the Industrial Department of the International Exhibition of 1862, 12mo., pp. 380.
Official Illustrated Catalogue of the International Exhibition of 1862, parts I. to VI.
Part I. Class I.—Mining, Quarrying, Metallurgy and Mineral Products.
" II.—Chemical Substances and Products, and Pharmaceutical Processes.
" III.—Substances used for Food, including Wines.
" IV.—Animal and Vegetable Substances used in Manufactures.
Part II. Class V.—Railway Plant, including Locomotive Engines and Carriages.
" VI.—Carriages not connected with Rail or Tram Roads.
Part III. Class VII.—Manufacturing Machines and Tools.
Part IV. Class VIII.—Machinery in general.
Part V. Class IX.—Agricultural and Horticultural Machines and Implements.
Part VI. Class X.—Civil Engineering, Architectural and Building Contrivances.
" XI.—Military Engineering, Armour and Accoutrements, Ordnance, and Small Arms.
" XII.—Naval Architecture and Ship's Tackle.

CLASS VI.

Universal Decorator, second series, 1 vol. 4to., 1860 .... *Thompson.*

CLASS XV.

International Exhibition of 1862, a Concise History of its Rise and Progress, its Building and Features, and a Summary of all Former Exhibitions, 1 vol. 8vo .... *John Hollingshead.*
Canadian Parliamentary Companion, 12mo., 1862 .... *H. J. Morgan.*
Overland Route to British Columbia, 12mo., 1862 .... *H. Y. Hind.*

CLASS XIX.

Parliamentary Papers received daily.

CLASS XX.

Scientific American, from commencement of new series, 1859.
American Gas Light Journal, from the commencement, 1859.

DRAFT OF A MEMORIAL OF THE BOARD OF ARTS AND MANUFACTURES FOR UPPER CANADA, PRAYING FOR CERTAIN AMENDMENTS TO THE PATENT LAWS OF THIS PROVINCE.

To the Honourable the Legislative Assembly of Canada, in Provincial Parliament assembled.

The Petition of the Board of Arts and Manufactures for Upper Canada, humbly sheweth:

That in the present state of the Patent Laws of this Province, none but *British subjects who are actual residents* in Canada, can obtain protection for any invention or discovery they may produce:

That your petitioners consider this unjust towards British subjects non-resident of Canada, and more especially towards such as are subject to the Patent Laws of the Imperial Government, which makes no distinction as to the country to which the applicant or inventor may belong, in the granting of Patent Rights:

That in respect to the Inventions of Foreigners, the Patent Laws of this Province are not based on those principles on which the Patent Laws of almost all other countries are established, that is, the absence of prohibitions and discriminating fees in the granting of Letters Patent:

That the Patent Laws of the United States have recently been so modified as to do away with all discriminating fees, on the condition set forth in section 10 of an enactment of the American Congress, of the 2nd of March, 1861, as follows:—"That all laws now in force fixing the rates of the "Patent Office fees to be paid, and discriminating "between the inhabitants of the United States and

"those of other countries, which shall not discriminate against the inhabitants of the United States, are hereby repealed:"

That under the said enactment of the American Congress, citizens of Canada are, in consequence of the prohibitory laws of this Province, altogether excluded from the benefit of taking out Patents in the United States:

That your petitioners believe such prohibitions to be detrimental to the interests of this Province, and especially so as to its inventors and artizans:

Wherefore your petitioners humbly pray, that your Honourable House will be pleased to pass the act prepared and submitted by the Board of Arts and Manufactures for Lower Canada, or such other act as to your Honourable House may seem best adapted to carry out the views of your petitioners, in doing away with all prohibitory or discriminating laws for the granting of Letters Patent in this Province:

And your petitioners will ever pray, &c., &c.

REPORT OF MR. E. A. McNAUGHTON.

(*Continued from page 114.*)

Peterborough.—Although I personally visited the different Manufacturers of this place, and received every information from them relative to their business operations, yet there are other places within the same County which I could not conveniently visit. Through the courtesy of Messrs. T. & R. White, of the *Peterborough Review*, I am enabled to give the different Manufactures within the County; they have published a pamphlet, based upon the census of 1861, shewing the Progress, Position, and Resources thereof, a copy of which has been handed to me, and from which I take such extracts as are necessary.

The principal manufacture of the County is that of sawed lumber. The immense water privileges which it possesses, and the fine timber which grows in its forests, will easily account for this.

There are 37 saw mills, cutting 68,821,000 feet of lumber per annum; this will shew, to each mill, an average of 1,860,027 feet. But although this shews the average, yet it by no means gives a correct return of some of the larger mills in the vicinity of Peterborough; for instance, this last year—and for lumberers a very bad one—the mill of William Snyder cut six million feet, while the capacity is double that; Hughson's six million, M. Boyd three million, Dixon's six million, Shaw & Waight four million, Ludgate six million, and others varying from three to four million. The capacity of these mills, however, is in most cases double the quantity here given. The number of men employed in the 37 mills is 537, and the cost per month of their labour is $13,940, or a little over $20 per month to each man. There have been shipped from Peterborough for the United States this year thirty million feet.

Next in importance to lumber manufacturing is the Flouring and Oat Meal mills. There are 12 flouring mills which have ground 345,000 bushels wheat, at a value of $340,786. The capital invested in these mills is $149,082; the number of hands employed are 28, and the labour per month $1061.

There are but two Oat Meal mills, and they are not of any great importance. The number of hands employed are only four, at a cost per month of $92. They consume 18,080 bushels of grain, valued at $5,735. and turn out 618 tons 850 lbs. of oat meal, valued at $12,548.

WOOL CARDING AND CLOTH DRESSING FACTORIES.

Of these there are four, the capital invested in which is $19,900—the number of hands employed being 26, 19 males and 7 females—the monthly cost of labour $377. The produce of the mills is as follows:—

22,000 yards cloth manufact'd,	The value of the produce being $14,656.
5,800 " " fulled,	
2,000 " flannel "	
24,300 lbs. wool carded,	

There is, however, another large Woollen Factory going up in Peterborough; it is the property of A. Robertson, Esq., of Montreal. He has taken a lease of the property for 99 years. It is his intention to put in all the latest improvements in machinery, so as to make it a first-class mill.

FOUNDRIES AND MACHINE SHOPS.

The number of such establishments are five—four of which are in Peterborough. The capital invested is $45,900. The value of the produce of these is $56,075. The quantity of raw material used is estimated at 192 tons of iron, and 46,000 feet of lumber—valued together at $5,584. The number of hands employed is 54, receiving an aggregate monthly return for their labour of $1,412.

TANNERIES.

The number are 8, and one about finished. The capital invested in these eight is $22,685. The raw material consumed is valued at $17,190. The number of hands employed is 21, and the monthly wages amount to $401. The products are 2,196 calfskins and 6,478 sides of leather, valued together at $34,173.

SASH AND DOOR FACTORIES, PLANING AND SHINGLE MACHINES.

These are combined under one head, as in several cases these articles are all manufactured under the one roof. There are 4 shingle machines, 3 planing machines, and 2 sash, door and blind fac-

tories, having an aggregate of capital invested of $7,100. The value of the raw material consumed is $6,651; the number of hands employed 34; the monthly wages $998; the return of produce 2,200,000 shingles, 327,500 feet lumber planed, 500 doors and blinds and 6,000 lights of sash—valued together at $11,000. But this by no means represents the value of labour performed. In the case of the sash and blind factory, the proprietors are general carpenters and builders as well; and the labour which they return is in great part occupied with this work, which is not included in the above returns.

AXE FACTORIES.

The principle Axe Factory is that of Mr. Mocock. He turns out about 800 axes per week. He has 26 men employed, wages $1 50 per day, but some of them make as high as $2 50. They are employed by the day.

The capital invested in the business is $8,000, and the raw material employed annually may be valued at $10,000. The products may be set down at $25,000. Peterborough is about to meet with a loss in this gentleman, who is going to remove to Montreal. I saw him on his return, and he informed me that he had taken a place in that city, and would remove his whole business there. His reason for doing so he explained—that it would be the saving of a large per centage to him; as the principal part of his stock was sold in Montreal, he would save the freight of the raw material and also the same on the manufactured article—these going over two lines of railroad.

The other factory is that of Mr. Ayer. He has, however, not been doing much during the past year; he employs only 3 hands, at a cost of $1,000 per year, and turns out axes to the value of $3,000.

BELLEVILLE.—There are a good many factories of various kinds in this place, such as foundries, axe factories, pail and tub factories, paper mill, wool carding and cloth dressing, saw mills, &c.

The principal Foundry is that of Messrs. Patterson & Bros. This is one of the largest Agricultural Implement manufactories in the Province. They turned out during the year 200 Reapers and Mowers, 200 Threshing Machines, 1500 Plows of various kinds (the steel plow, however, is in greatest demand), 200 Cultivators, 150 Straw Cutters, 100 Fanning Mills, 50 Grain Mills for grinding chop, besides general work. They employ from 50 to 60 men, the wages averaging $1 25—the operations during the year about $75,000.

A. E. Proctor, Axe and Edge Tool maker. His capacity when in full order is 6 fires, the daily work of which is 20 axes to each fire—making 120 per day. It takes 2 men to each fire. The total men employed from 15 to 20. As is generally the case in this line of business, the men are employed by the day, and average from $1 50 to $2 00 per day.

John Walton, Sash, Door, Blind and Moulding factory, is under the same roof as the above, which is a very fine shop. He is, however, just starting operations.

The Saw Mills of Messrs. Billa Flint and D. Boggart are the two largest; the former is capable of cutting 80,000 feet of lumber per day, and the latter 60,000. At this season of the year, however, there is nothing doing in the saw mills; all hands are engaged in getting out logs for the spring and summer operations. A fair estimate of the number of hands employed to run these mills cannot be given at this time.

KINGSTON.—In this city there are several large Mechanical Establishments. The first in importance is that of P. Morton's Locomotive Works. The average number of men employed is 80, and average of wages, both men and boys, is 6s. 8d. Some of these men, however, make as high as $2 50 per day. Their work is altogether heavy work, railway locomotives, marine engines and heavy machinery. They have some locomotives under way just now; these, when completed, are worth $11,000. The English locomotives cost $15,000, and they do not suit so well for this country; at all events they have been proved so, as they give out much sooner.

The value of work turned out in 1861 is estimated at about $70,000.

Chewitt & Co., Founders and Manufacturers of Bar Iron from scrap. They are also manufacturing patent Axles. They do a very extensive business. It was not, however, convenient to have the estimate. They employ men and boys from 30 to 40, the wages of whom are from 75c. to $2 50 per day.

Davidson, Bruce & Doran, Founders. They are manufacturers of Marine Engines and general work. As their establishment is a first-class one, it is necessary to have men of the same class. They employ 45, the wages of whom will average from $2 50 to $2 75 per day. During the past year—and it was a dull one—they turned out about $40,000 worth of property. At present they are busily engaged in fitting up steamers, which are out of repair.

Ross & Strange, Boot and Shoe Manufacturers. They have the labour of the Penitentiary engaged. They pay 40c. per day for each man. They turn out as high as 500 pairs per day. It is now a number of years since this firm first started en-

gaging such labour; at first it was a losing concern, but after the first year or two they got the men broken in so as it at present pays them for their experiment. They have large tanneries, and supply all or most of their own material.

Mr. Drenan, Cabinet Ware, has his hands employed as the above. The number is 50. He manufactures upon the average about $30,000 worth per annum.

Prescott.—There are two Foundries. At present business is very dull, and consequently most of the hands are discharged.

Mr. S. Hulburt manufactures Plows and Stoves. He at present manufactures 500 per year, but if he had command of capital he could dispose of from 800 to 1000 per year. He is a thorough mechanic; he has patented 3 plows; he sent one to the Exhibition in 1851, and succeeded in taking a prize.

S. Bretrand, Axe Manufacturer. There are 5 hands employed. His business is altogether local. In this shop I saw two machines invented by Mr. Bretrand, which I think worthy of notice, and would, to Blacksmiths and others who have not the advantage of any motive power, prove very economical machines.

The one is called a "Hand-power Nut-punching and Cutting Machine." The other is a "Bolt and Nut Cutting Machine." The first is worked upon Eccentric Lever principle. In working it the punch is placed in front; the bar of iron is pushed through under it, and the pressure is applied by hand. The hole is punched with the greatest of ease, and as quickly as if done by machinery. In cutting the nut through, or breaking them off as it is termed, the lever works on the back part of the machine; the bars are shoved through, and regulated by a spring; the pressure is applied, when the nut is instantly cut off; the edges are as smooth as if filed. The second machine is for putting the threads upon the bolts and nuts. The nuts are strung upon a piece of iron and placed into the machine, which is self-adjusting; the tap is sufficiently long to hold a dozen nuts; it is turned with a crank, when it runs right through them. The bolts are also placed in the same machine, when the threads are cut with dies made suitable to the size.

The first machine, complete with all the necessary dies, punches, &c., &c., from the very finest washer to the thickness of a ⅝ nut and 2 inches square, will be sold for $80.

The other machine, with the dies and taps for making threads of any size, $30. These machines are calculated to do the work of 10 men.

Ottawa City.—In this city there are a number of machine shops, factories, &c.

N. S. Blasdill & Co., Foundry and Machinists. The principal work is heavy mill work. They are at present engaged in making machinery for a woollen mill; they are also making planing mills. This planing mill is a new machine, differing from anything of the kind either made in Canada or the United States. It is calculated to do the work of 200 men at a fair rate of work. It was the intention of this firm, if time had permitted, to have sent one of these mills to the International Exhibition, where we are quite sure they would have carried off a medal. They employ 30 men, the average wages of whom will be $1 25 per day.

Messrs. Tongue & Brown, Axe and Edge Tool Manufacturers, do a large trade. They have a very extensive local retail trade as well as wholesale. The capacity of the factory is equal to 1800 boxes per month, but of course they do not turn out this quantity at present.

There is perhaps no establishment in the Province where so many variety of Tools are turned out as in this. They had a beautiful case of tools —166 pieces—exhibited in the Montreal Fair; I hope they may have such an one at the World's Fair. Mr. Tongue is a thorough practical man. They employ 12 men—wages average $1 55 per day.

Mr. Burret, Woollen Factory, manufactures during the year 110,000 yards; this includes flannel and blankets as well as cloth. He manufactures a beautiful article of light summer Tweed, also heavy Tweeds for winter. His blankets are coloured for the lumber shanties.

There are two sets of Carders and 570 spindles in the mill.

The coarse wool is bought in the counties adjoining, and the fine wool is imported from New York.

He employs 50 hands. The average wages of men $1, women 45c.

E. B. Eddy, Tub, Pail, Match Manufacturer, &c., &c. This Establishment is the largest of the kind in the Province, and if we take the different departments combined, it is the largest on the continent of America. The number of hands employed exclusive of those getting out the raw material, is 175; these are working in the establishment, but there are besides these some 20 or 30 families who are engaged in preparing paper boxes, &c., for the works. I could not arrive at the exact number of individuals who were in this way engaged, the jobs being set to them by the gross. This, like most of the establishments where Americans are proprietors, the articles are made by the dozen or gross;

each person is bound to turn out so much each day; if they fail in this they are discharged. By this means not only is the cost price of each article known, but when an order is sent forward they can tell to an hour when the goods can be shipped.

In visiting an establishment of this kind, not only does one derive much pleasure, but some profit.

They turn out per day 800 pails, 200 wash tubs, 100 zinc wash boards, 60 gross clothes pins, 100 dozen broom handles, 150 gross matches, besides many other things in the wooden ware line. In making a pail it goes through a good many operations, and at each time by a separate individual. The staves are first cut to the proper length; they are then placed into a machine, which hollows out the inside and rounds the outside; they are then jointed, passed from that to be tongued and grooved; they are now ready to be put up, which is done in quick style; as the staves are all cut the same width, there is no time lost in picking out the proper size. They are formed upon an iron cylinder, and turned off on the outside; the hoops, being already prepared by another person, are run on tight by a small machine. They are then passed to another who turns out the inside; they are then passed to have the bottom put in; this is the principal part of the work, although they have to get the ears and bails put on, and painted and varnished, before they are ready for the market.

In the match department it is principally girls that are employed. Although the occupants seem to be both lively and healthy enough, yet few visitors would like to remain long, especially if he is at all asthmatic, for the place is perfectly impregnated with sulphur—in fact there is a complete haze, which is rather ominous.

Wright & Fairchurch, Wooden Ware Manufacturers. They make nothing but round butter bowls. They make 30 nests per day, 4, 5 and 6 in a nest, according to the size of the stick. These they sell at 10c. per foot.

There are 5 Gristing and Flouring Mills in Ottawa, having in all 22 run of stone. They all do a good business, and altogether home consumption.

Messrs. McKay & Co., whose mill is the largest, last year ground for themselves 74,000 bushels of wheat; at the same time they did gristing for farmers, 17,200 bushels, but as they had made up their returns for the month of January of this year, I will give that statement, which is altogether for local consumption. Of course the principal part were for lumberers—2,400 barrels flour. Ground 3,679 bushels wheat, 262 barrels oat meal, 6,500 bushels oats, 15 tons provender, and 60 tons of bran.

The Messrs. McKay have put up a very large stone mill, of 5 run of stone. It was just completed and about to start.

The Lumber and Timber trade is the most important branch of manufacturing in Ottawa. Parties who are not acquainted with this branch of industry have no conception of the quantity of lumber and deals which are yearly turned out from these mills.

The quantity of lumber manufactured last year —and it is not near to the quantity which is generally done—is 65 million feet, which is divided under the following:—

Gilmour & Co.	20	million.
J. M. Currier & Co.	12	"
Harris, Bronson & Co.	10	"
Perley, Pattie & Co.	8	"
Young & Co.	6	"
Baldwin	5	"
Booth & Soaper	4	"
	65	million feet.

Besides that quantity there is taken out at Buckingham, about 18 miles northeast of Ottawa City, from G. W. Eaton's mill, 16 million; Thomson & Co.'s 16 million; and at Hawkesbury, a little further down, Hamilton's mill 25 million—making in these 10 mills alone the immense quantity of 122 million feet. A third of that quantity is manufactured into lumber for the American market; the balance in *deals* for the English market. Although under the quantity set down to Gilmour & Co. is 20 million, that gives no idea of the quantity manufactured by them at their various establishments, that quantity being Ottawa City alone. The whole quantity may be set down at nearly 50 million feet, besides 1½ million feet of square timber.

J. M. Currier & Co., whose name is given, also has in connection with his saw mill, a planing mill, sash and door factory, &c., &c.

The capacity of his mill during six to seven months in the year is 70,000 logs; these logs are floated down the Cavana River, which empties into the Ottawa. Some of the logs are brought as much as 75 miles from the mill. They employ about 150 hands in the summer season; they are engaged principally by the month at from $10 to $16, and those who are engaged by the day are paid, in the mill 4s. 9d., in the sash factory 6s. per day. The whole of the sash, doors, blinds, &c., are for local consumption. Doors can be obtained from them 2 feet 6 by 6 feet 6 for $1, and 3 feet wide by 7 feet high, panneled, moulded, complete, $2 75. They manufacture a Clapboard, for which a patent

has been granted. It is so dressed that it is bevelled off at one end, and at the other a groove is made with a rabit; the bevelled end fits into the groove and overlaps the same as an ordinary one, but the back of it becomes a plane surface, so that they lie perfectly close to the studs. In this way it obviates the old system of having an open space at each lap.

Mr. Skead is employed in the timber trade; he employs about 200 men in the woods, besides 75 team of horses and 15 yoke of oxen. He takes out about 600,000 cubic feet of red and white pine.

The quantity of timber which is expected to be taken out this year in Ottawa is estimated at 20 million feet of pine; out of that quantity there will be about 3½ millions of red pine; the balance is white. There has been for years back a prejudice against the Canadian red pine, the Baltic being taken in preference. This, however, was not because the latter was better than ours, for upon a comparison being made, the Canadian is rather the better of the two. The great reason is traceable to architects and contractors, who, in giving in their estimates, generally put down the Baltic, without knowing or perhaps caring anything about the other. By this means the contract had to be carried out to the letter. We hope, however, that at the World's Fair this year they may stand side by side, and that a fair and unbiased decision may be given.

As to my success in securing the promise of Manufacturers to prepare articles for the International Exhibition.

The general plan which I formed was, wherever there was a Mechanics' Institute, to put myself in communication with some of the officers of it, most generally the Secretary. Although their coöperation was solicited—and some cases had—yet I found it more practicable and to the purpose to personally wait upon manufacturers. By this method I secured promises from many who had no intention of doing anything, and this was only effected by pointing out the special benefits the Province at large would receive therefrom. There were, however—and to the credit of the Province be it said they are few—some so exceedingly selfish that they could not see beyond themselves—"they were not going to receive any benefit therefrom, and therefore were not going to the trouble and expense of putting up goods for the benefit of others."

The great drawback, I find, has been the shortness of time allowed after the Commission had been appointed. I found, in almost every instance, that they had received circulars, and therefore no blame could be attached to them.

Another drawback, however, I found in the uncertainty of the goods going forward, after the final selection in Montreal. There is necessary much time and extra expense attached to the getting up of heavy machinery so as to make a creditable appearance at such an Exhibition. Many of our manufacturers, therefore, would not run the risk of having their goods returned after going to such extra expense. I fear, therefore, that although there will be many branches of industry represented, yet there will be a good many that will not; and even those which will go forward cannot be said that they are a fair represeutation of what Canada can do.

To the gentlemen of Ottawa, and especially those engaged in the lumber and timber trade, I am much indebted for kindness, not only personally, but for information relating to their operations, and for the hearty manner in which they came forward to offer their several contributions, which I am certain will be well represented.

E. A. McNaughton.

BRITISH PUBLICATIONS FOR MARCH.

Alison (A.) Improvement of Society and Public Opinion, 8vo	£0	3	6	*G. H. Nicholls.*
Allshorn (Geo. Edw.) Handy Book of Domestic Homœpathic Practice, cr. 8vo	0	3	0	*Houlston.*
Ammianus Marcellinus' Roman History, translated by C. D. Young, post 8vo	0	7	6	*Bohn.*
Appia (P. L.) Ambulance Surgeon, edited by T. W. Nunn and A. M. Edwards, p. 8vo.	0	6	0	*Black.*
Arrivabene (Count John) An Epoch of my Life, trans. by C. Arrivabene, post 8vo	0	7	6	*Booth.*
Barrett (A. C.) Propositions in Mechanics and Hydrostatics, 3rd edition, with adds., cr. 8vo	0	6	0	*Bell & Daldy.*
Biographies of Good Women, chiefly by Contrib. to "The Monthly Packet," fp. 8vo.	0	6	0	*Mozley.*
Birdsnesting; being a Description of the Nest and Eggs of every British Bird	0	1	1	*E. Newman.*
Blake (Rev. J. L.) Historical, Biographical, and Poetical Reader, 12mo	0	2	0	*Allman.*
Bohn's English Gentleman's Library, Maxwell's Life of Duke of Wellington, Vol. 1, 8vo	0	9	0	*Bohn.*
Book and its Story (The), by L. N. R., 85th thousand, 16th edit., cr. 8vo, stiff, 2s	0	2	6	*Kent.*
Burn (Robt. Scott) Lessons of my Farm, a book for Amateur Agriculturists, fp. 8vo.	0	6	0	*Lockwood.*
——— Year-Book of Agricultural Facts, for 1861, sm. cr. 8vo	0	3	6	*Blackwoods.*
Bush Wanderings of a Naturalist, Notes on the Fauna, &c., of Australia, new edit., illustrated, fcap. 8vo	0	3	6	*Routledge.*
Carson (James C. L.) Form of the Horse, 2nd edit., fcap. 8vo	0	3	6	*Simpkin.*

BRITISH PUBLICATIONS FOR MARCH—*Continued.*

Chateau Frissac; or, Home Scenes in France, by Chroniqueuse, cr. 8vo.	0	7	6	*Tinsley.*
Chronicles, &c., of Great Britain, Munimenta Gildhallæ Londoniensis, v. 3, roy. 8vo.	0	8	6	*Longman.*
Cooke (M. C.) Manual of Botanic Terms, illustrated, fcap. 8vo	0	2	6	*Hardwicke.*
Corrigan (Dr.) Ten Days in Athens, with Notes by the Way, post 8vo	0	7	6	*Longman.*
Cranborne (Viscount) Historical Sketches and Reviews, 1st series, 2nd edit., 8vo	0	12	0	*J. Mitchell.*
Croker (T. Crofton) Fairy Legends and Traditions of the South of Ireland, new edition, cr. 8vo	0	5	0	*Tegg.*
DeQuincy (Thomas) Works, new edition, Vol. 2, Recollections of the Lakes and Lake Poets, cr. 8vo	0	4	6	*Black.*
Dinners and Dinner-Parties; or, the Absurdities of Artificial Life, 2nd edit., post 8vo.	0	3	6	*Chapman & H.*
Dowling (Wm.) Poets and Statesmen, their Homes and Haunts, 8vo. red. to	0	10	6	*Griffin.*
English Catalogue of Books (The) for 1861, roy. 8v	0	3	6	*Low & Tucker.*
English Retraced; or, Remarks on the Breeches Bible and English of the Present Day, cr. 8vo	0	5	0	*Bell & Daldy.*
Galignani's New Paris Guide for 1862, revised, 12mo, bd. 7s. 6d.; Plates	0	10	6	*Simpkin.*
Gleig (Rev. G. R.) Life of Arthur, Duke of Wellington, 8vo	0	15	0	*Longman.*
Gmelin (Leopold) Hand-Book of Chemistry, Vol. 1, translated by Henry Watts, 2nd edit., revised, 8vo	0	10	6	*Harrison.*
Harrison (R.) Colonial Sketches; or, Five Years in South Australia, 12mo	0	2	6	*A. Hall.*
History (The) of Printing, illustrated, fcap. 8vo	0	2	6	*Soc. Pr. C. Kn.*
Holland, the Campaign in, 1799, by a Subaltern, 12mo	0	2	6	*Mitchell.*
Holmes (Sir W.) Free Cotton; How and Where to Grow it, 8vo	0	1	0	*Chapman & H.*
Kipping (Robert) Elementary Treatise on Sails and Sailmaking, 6th edit., enlarged, cr. 8vo	0	2	6	*C. Wilson.*
Knox (Robert) Races of Men, 2nd edit., with Supplementary Chapters, cr. 8vo	0	10	6	*Renshaw.*
Mitchell (O. M.) Orbs of Heaven and Popular Astronomy, in 1 vol., cr. 8vo	0	5	0	*Routledge.*
Molinaux (Thos.) Concise Introduction to the Knowledge of the Globes, new ed., 12mo.	0	3	0	*Whittaker.*
National Association for the Promotion of Social Science Transactions, 1861, 8vo	0	12	0	*Parker & Son.*
Rankine (W. M. J.) Manual of Civil Engineering, in 2 vols., cr. 8vo	0	16	6	*Griffin.*
Shaffner (Col. Tal. P.) War in America; an Account of the Southern and Northern States, &c., cr. 8vo	0	7	6	*Hamilton.*
Shakespeare Cyclopædia (The), Part 1, by J. H. Fennell	0	1	0	*J. R. Smith.*
Sidney (Rev. Edwin) Electricity; its Phenomena, Laws and Results, new ed., fp. 8vo.	0	2	0	*Rel. Tr. Soc.*
Thomson (R. D.) School Chemistry, Practical Rudiments of the Science, 2nd ed. fp. 8vo.	0	6	6	*Longman.*
Volunteer's (The) Book of Facts; an Annual Record, edit. by W. H. Blanch, 8vo	0	2	0	*Mitchell.*
Westfield (T. Clark) The Japanese; their Manners and Customs, with Stereo. Ill., fcap. 4to	0	7	6	*Photo. News Off.*
Wilde (W. R.) On the Malformations and Congenital Diseases of Organs of Sight, 8vo.	0	7	6	*Churchill.*
Yacht Sailor (The), a Treatise on Practical Yachtmanship, by Vanderdecken, post 8vo.	0	7	6	*Hunt & Co.*
Young (Sir George) On the History of Greek Literature in England, cr. 8vo	0	2	0	*Macmillan.*

RULES AND REGULATIONS FOR THE NEXT PROVINCIAL EXHIBITION.

In our last issue we announced, in connection with the Prize List then published, that September the 30th to October the 3rd had been fixed upon for holding the next Provincial Show; but in consequence of its having been since ascertained that the Show for the State of New York has been advertised for the same days, the Association has determined to hold their Exhibition in Toronto one week earlier, so that parties desirous of attending both may have an opportunity of doing so.

SEVENTEENTH ANNUAL EXHIBITION OF THE PROVINCIAL AGRICULTURAL ASSOCIATION, TO BE HELD AT TORONTO, ON SEPTEMBER 22ND, 23RD, 24TH, 25TH AND 26TH, 1862.

RULES AND REGULATIONS.

Membership.

1. The members of the Agricultural Societies of the several Townships within the County, or Electoral Division or United Counties, wherein the Annual Exhibition may be held, and the members of the county or Electoral Division Society, shall be also members of the Association for that year, and have members tickets accordingly; provided the Agricultural Societies of the said Townships, or the Society of the said County or Electoral Division or United Counties, shall devote their whole funds for the year, including the Government Grant, in aid of the Association, and shall pay over the same to the Treasurer of the Association two weeks previous to the Exhibition.

2. The Members of the Board of Agriculture, and of the Board of Arts and Manufactures, the Presidents and Vice-Presidents of all lawfully organized County Agricultural Societies, and of all Horticultural Societies, are members of the Agricultural Association for Upper Canada, *ex officio.* The payment of $1 and upwards constitutes a person a member of the Association for one year; and $10 for life, when given for that specific object, and not as a contribution to the local funds.

3. Members can enter articles for competition in every department of the Exhibition, at any time previous to the dates below mentioned, and all who become members previous to or on the Saturday preceding the show will be furnished with tickets admitting them to the grounds during the whole time of the show, without additional charge.

Entries.

4. No one but a member shall be allowed to compete for prizes except in class, 41, sections 9 to 15 of 47, and 54.

5. All entries must be made on printed forms, which may be obtained of the Secretaries of Agricultural Societies, or of Mechanics' Institutes, free of charge. These forms are to be filled up and signed by the exhibitor, enclosing a dollar for membership, and sent to the Secretary of the Association, Board of Agriculture, Toronto, previous to or on the following named dates:—

6. *Horses, Cattle, Sheep, Swine, Poultry.* Entries in these classes must be made, by forwarding the entry form, as above mentioned, filled up, and member's subscription enclosed, on or before Saturday, five weeks preceding the show.

7. In the classes of Blood Horses and pure bred cattle, full pedigrees, properly certified, must accompany the entry. No animals will be allowed to compete as pure bred, unless they possess regular Stud or Herd Book pedigrees, or satisfactory evidence be produced that they are directly descended from such stock. In the class of Durham cattle particularly, no animal will be entered for competition, unless the pedigree of the same be first inserted in the English or American Herd Book, or in the Upper Canada Stock Register, kept at the office of the Board of Agriculture.

8. *Grain, Field Roots, and other Farm Products, Agricultural Implements, Machinery, and Manufactures generally,* must be entered previous to, or on Saturday, three weeks preceding the show.

9. *Horticultural Products, Ladies' Work, the Fine Arts, &c.*, may be entered up to Saturday, one clear week preceding the show.

10. After these dates for the respective classes, no entry will be received. The entry paper and subscription money will be returned to any person forwarding them.

11. In the live stock classes, the entry must in in every instance be made in the name of the *bona fide* owner; and unless this rule be observed no premium will be awarded, or if awarded will be with-held.

12. In all the other classes entries must be made in the names of the producers or manufacturers only.

13. In the Agricultural department the competition is open to exhibitors from any part of the world.

14. In the Arts and Manufactures department, no article can be entered for competition unless it be the growth, product, or manufacture of Canada; and no money premium will be awarded except in accordance with this rule; articles of foreign manufacture, however, may be entered for exhibition only, and will be reported upon by the judges, according to their merits, or certificates awarded them, if deserving. Manufacturers are requested to furnish with their articles exhibited, the quantity they can produce, or supply, and the price, for the information of the Judges; whose decision will be based on the combination of quality, style, and price, and the adaptation of the article to the purpose or purposes for which it is intended..

15. No person shall be allowed to enter for exhibition more than one specimen in any section of a class, unless the additional article be of a distinct named variety, or pattern, from the first. This rule not to apply to animals, but to apply to all kinds of grain, vegetable products, fruit, manufactured articles, &c., in which each additional specimen would necessarily be precisely similar to the first.

16. On the entry of each animal or article, a card will be furnished the exhibitor specifying the class, the section, and the number of the entry, which card must remain attached to such animal or article during the exhibition.

Transport of Articles, placing them on Exhibition and charge of them while there.

17. All articles for Exhibition must be on the grounds on Monday, of the show week, except live stock, which must be there not later than Tuesday at noon. Exhibitors of machinery and other heavy articles, are requested to have them on the ground as far as possible during the week preceding the show.

18. Exhibitors must provide for the delivery of their articles upon the show ground.—The Association cannot in any case make provision for their transportation, or be subjected to any expense therefor, either in their delivery at or return from the grounds; all the expenses connected therewith must be provided for by the Exhibitors themselves.

19. Articles not accompanied by their owners may be addressed to the care of the superintendent of the exhibition, who will receive them, on their being delivered at the grounds; but in no case will such articles be brought on the grounds and placed on exhibition, except by and at the expense of the owners, or their authorised agents.

20. Exhibitors on arriving with their articles will apply to the superintendent of the grounds, who will be stationed within the entry gate, and will inform them where the articles are to be placed.

21. Exhibitors will at all times give the necessary personal attention to whatever they may have on exhibition, and at the close of the show take entire charge of the same.

22. No articles or stock exhibited will be allowed to be removed from the grounds, till the close of the exhibition, upon the delivery of the President's address, on Friday afternoon, under the penalty of losing the premiums.

23. While the Directors will take every possible precaution, under the circumstances, to insure the safety of articles sent to the exhibition, yet they wish it to be distinctly understood that the owners must themselves take the risk of exhibiting them; and that should any article be accidentally injured, lost, or stolen, the Directors will give all the assistance in their power towards the recovery of the same, but will not make any payment for the value thereof.

Steamboats, Railroads, Customs.

24. The Association will make arrangements with Steamboat and Railroad proprietors for carrying articles and passengers at reduced rates.

25. Arrangements will be made with the Customs department for the free entry of articles for competition.

Admission to the Grounds.

26. Tickets from the Secretary's Office will be furnished each person becoming a member previous to or on Saturday, preceding the Show, which will admit himself only, free to every department of the exhibition, during the Show. Life members admitted free throughout the Exhibition.

27. No members' tickets will be issued after the above last mentioned Saturday evening, but those issued up to that time will be good till the close of the show.

28. Necessary attendants upon stock and articles belonging to exhibitors, will be furnished with admission tickets with their names written upon them, which ticket will be good at the *Exhibitors' gate only*, during the show.

29. The admission fees to non-members, on Tuesday and Wednesday, will be half-a-dollar, and on Thursday and Friday, a quarter dollar, each time of entering through the gates.

30. Tickets of admission to those who are not members, will be issued on and after Tuesday morning, at 25 cents each—two such tickets to be given up at the gates each time of admission, on Tuesday and Wednesday, and one such ticket on Thursday and Friday, in accordance with the above rates. Children under fourteen years of age, half price. Carriages to pay one dollar each admission; each occupant, except the driver, to be also provided with the usual admission ticket. Horsemen half-a-dollar.

Judges and their Duties.

31. The judges will be appointed by the council of the Association previous to the Exhibition, and will receive a circular informing them of the fact and inviting them to act.

32. The judges are invited to report themselves at the Secretary's office, presenting their circular of appointment, immediately on their arrival at the grounds.

33. The judges will meet, at the committee room on the grounds, on Tuesday, at 10 o'clock, A. M., to make arrangements for entering upon their duties, and will then be furnished with the committee books containing the numbers of the entries in each class.

34. No person shall act as a judge in any class in which he may be an exhibitor.

35. In addition to the stated premiums offered for articles enumerated in the list, the judges will have the power to award discretionary premiums for such articles, not enumerated, as they may consider worthy, and the Directors will determine the amount of premium.

36. In the Fine Arts and Mechanical Department, Diplomas will be awarded—in addition to the money prizes—to any specimen evincing great skill in its production, or deemed otherwise worthy of such a distinction, on its being recommended by the Judges and approved of by the Committee to whom all such matters shall be referred.

37. In the absence of competition in any of the Classes, or if the Stock or articles exhibited be of inferior quality, the Judges will exercise their discretion as to the value of the premiums they recommend.

38. Each award must be written in a plain, careful manner, on the blank page opposite the number of the entry; and the reasons for the award should be stated when convenient.

39. No person will be allowed to interfere with the judges while in the discharge of their duties. *Exhibitors so interfering will forfeit their rights to any premium to which they might otherwise be entitled.*

Delegates, the Annual Meeting, &c.

40. Delegates and members of the Press are requested and expected to report themselves at the Secretary's office immediately on their arrival.

41. The Annual Meeting of the Directors of the Association will take place on the grounds on Friday morning at 10 o'clock.

42. Delegates from County Societies desiring to obtain a portion of the Canada Company Prize Wheat for their Counties, will please apply for it before leaving the exhibition, and take it with them from thence.

The General Superintendent.

43. A General Superintendent will be appointed, who will have the entire supervision of the grounds and the arrangements of the Exhibition. He will have an office upon the ground, where all persons having inquiries to make in relation to the arrangements will apply.

Paying the Premiums.

44. The Treasurer will be prepared to commence paying the premiums on Saturday, at 9 A. M., and parties who shall have prizes awarded them are particularly requested to apply for them before leaving Toronto, or leave a written order with some person to receive them, stating the articles for which prizes are claimed.

45. Persons entitled to cash premiums must apply for them at the Secretary's office, who will give *Orders on the Treasurer* for the amount.

46. These orders must be endorsed, as they will be payable to *order*, not to *bearer*, and on presentation to the Treasurer, properly endorsed, will be paid, either in cash, or by cheque on the Bank.

47. Orders for premiums not applied for on Saturday, as above, will be given by the Secretary, and the amount forwarded by the Treasurer, on receipt of proper instructions.

Miscellaneous.

48. Provender will be provided by the Association for live stock at cost price. For information Exhibitors will apply to the Superintendent of the grain and fodder department at his office.

49. An auctioneer will be on the ground after the premiums are announced, for the purpose of selling any animal or article which the owner may wish to dispose of, and every facility will be afforded for the transaction of business.

50. In case the Directors shall require any particular information in reference to animals or articles taking first prizes, the owners will be expected to transmit it when requested to do so.

Programme for the Week.

1. MONDAY will be devoted to the final receiving of articles for exhibition, and their proper arrangement. None but officers and members of the Association, judges, exhibitors, and necessary attendants will be admitted.

2. TUESDAY.—The judges will meet in the Committee Room at 10 A. M., and will commence their duties as soon as possible afterwards. As soon as they have made their awards, they will report to the Secretary, and will then be furnished with the prize tickets, which they are requested to place on the proper articles before dispersing. Non-members admitted this day on payment of 50 cents each time.

3. WEDNESDAY.—The judges of the various classes will complete their awards, and will place all of the prize tickets if possible. Admission this day the same as yesterday.

4. THURSDAY.—All the remaining prize tickets not yet distributed by the judges will be placed upon the proper articles this morning, before 9 o'clock, if possible. The public will be admitted this day on payment of 25 cents by each person, each time of entering. The amateur bands of music in competition for prizes will play upon the grounds.

5. FRIDAY.—The annual meeting of the Directors of the Association will take place at 10 A. M., in the Committee Room. The bands will continue to play upon the grounds. The President will deliver the Annual Address at 2 P. M., after which the Exhibition will be considered officially closed, and exhibitors may commence to take away their property. Admission to-day the same as yesterday.

6. SATURDAY.—The Treasurer will commence paying the premiums at 9 A. M. Exhibitors will remove all their property from the grounds and buildings. The gates will be kept closed as long as necessary, and none will be admitted except those who can show that they have business to attend to.

Proceedings of Societies.

THE TORONTO MECHANICS' INSTITUTE.

The Annual Meeting of this Institution was held on the evening of Monday, the 12th instant, for the purpose of receiving the Report of the retiring Directors, and to elect office-bearers and Directors for the ensuing year.

The President, Rice Lewis, Esq., occupied the Chair.

The Minutes of the previous meeting having been read and approved of, the Secretary read the thirty-first Annual Report, from which we take the following extracts:—

"The Directors have much pleasure in congratulating the members on the great prosperity which has attended the affairs of the Institute during the year just closed.

The New Building.

"Since last annual meeting the new building has been entirely completed; the handsome and commodious Music Hall and Lecture Room have been opened to the public; the various departments specially for the use of the Institute have been elegantly and comfortably furnished, while the several spare rooms throughout the edifice have been rented.

"The Board desires to congratulate the members on the prospect that is presented of a large annual income from the permanent and casual rent of the Music Hall and Lecture Room, and the various minor apartments. Since the building was opened in July, the large sum of nearly two thousand dollars has been received for rents alone. The Music Hall is now the largest and handsomest public room in Toronto, and every way the best fitted and most suited for public entertainments. There were a few acoustic defects in the Hall for some time, but such alterations have been made as have rendered it as nearly perfect in this respect as possible. The Lecture Room has attained much popularity.

Membership.

"For three or four preceding years it has been been the disagreeable duty of the Directors to record a gradual decline in the membership, but they are happy in being able to state that since last annual meeting there has been in this respect a large increase.

"The number of members at the date of last annual report was—

Honorary members		18
Life members		86
Members		449
Of subscribers		67
Making a total of		620
From which deduct by deaths, removals and withdrawals		159
Leaving		461
New members admitted during the year,	351	
New subscribers	177	
		528
Total number at date		989

Being an increase of no less than 369 in a single year.

Finances.

"The total Receipts for the year, from all sources, amount to $13,684 69; the Expenditure to $13,591 64; leaving a balance in hand of $93 05; an analyzed statement of which will be found in Appendix A to this Report.

"A full statement of all monies received and payments made, on account of the Building fund, is found in Appendix B. Appendix C furnishes a complete statement of the Assets and Liabilities of the Institute.

"An estimate of probable Revenue and current expenditure for each year, based upon past experience, is submitted in Appendix D.

"The Directors recommend that the subscriptions for life membership be reduced to $20, and that monies derivable from this source be invested in a sinking fund for the liquidation or reduction of the debt.

The Library.

"The Board, fully aware of the absolute necessity that existed for the immediate purchase of new books, at once appropriated a large sum for that purpose, and in a very short time not less than 500 vols. of the latest and most interesting works were placed on the shelves. A large number of lost and worn-out books, also, were replaced, and the Library generally overhauled and renewed.

"The total number of books, according to last annual report, was	4,035
Added by purchase during the year	967
Bound up from Reading Room	43
Donations	22
Making a total of	5,067

"The Library has been so greatly increased that a new catalogue was deemed absolutely necessary. The Directors accordingly made arrangements for an improved classification of the books, and the issue of a catalogue, the matter for which is in the hands of the printer, and will be completed in the course of a few weeks.

"The demand for books has been so great that the Directors considered it would be to the interest of the Institute to have the Library kept open daily from 9 A. M. to 10 P. M., or for 13 hours, instead of 7 hours, as heretofore. This change has no doubt proved of much convenience to the members.

"The greater attendance consequently required, and the extension of the general business of the Institute, necessitated the appointment of an Assistant Librarian.

Reading Room.

"The Reading Room, the next department in importance, has also been much improved, by the introduction of several additional publications, as well as by the greater regularity with which the periodicals are supplied.

"The systematic arrangement of this department and the numerous appliances which have been obtained, cannot fail to afford the members much comfort and convenience."

Here follows a list of 31 British; 43 Canadian, and 17 American Publications received in the Reading Room; 37 of which are furnished gratuitously by their publishers and others.

The Directors also report that so much time and attention had been required in completing and furnishing the building, and in other important departments, that no arrangements had been made for lectures, and only one class had been organized during the year.

The Chess Club.

"Since the last annual meeting a new feature has been added to the Institution. Several members frequently urged on the Directors the advisability of establishing a club for practice in the scientific game of Chess, and proposed to co-operate in its formation. The Directors agreed to their proposals on stipulated conditions, providing the Institute against loss in case the enterprise should not succeed. The club was accordingly established and styled the 'Mechanics' Institute Chess Club.' The Directors have pleasure in reporting that so far the Club has succeeded, and they have no doubt, that with a little exertion on the part of its members (who at present number between fifty and sixty), it will continue to prosper."

The Inauguration.

The Directors, after referring to an opening Soiree, which, owing to the intense war excitement prevailing at the time, was a practical failure, report that a Bazaar on the succeeding day and evening, under the sole management of a Committee of Ladies, "who, with most praiseworthy alacrity" offered their services on the occasion, was entirely successful, and resulted in a profit to the Institute of nearly four hundred dollars.

The Exhibition.

"The Board of Directors for the preceding year entered into an arrangement with the 'Toronto Electoral Division Society,' to hold a joint Exhibition of Arts, Manufactures, and Agricultural and Horticultural productions, on the basis of an agreement adopted by both bodies.

"In accordance with this agreement, the exhibition was opened in the Music Hall and adjoining rooms on the 7th of October, and continued open for two weeks. The result, however, did not meet the reasonable anticipations of the Board, either in a financial point of view, or as an exposition of the arts and manufactures of this city.

"Of the 614 entries made by exhibitors, but 77 were for manufactured articles, 143 fine arts, and 62 ladies' work. The remaining 332 entries were for agricultural and horticultural products. The total amount offered in prizes was nearly $1,000, of which upwards of $600 was in the department of arts and manufactures. The total receipts were $952.07; expenditure $927.75; balance to divide between the two societies $24.32.

"The Directors cannot but express their surprise at the little interest the manufacturers of Toronto, especially those who were members of the Institute, manifested in the exhibition, where so favorable an opportunity was afforded for displaying their various productions, and at the same time indirectly contributing to the funds for the liquidation of the debt on the building. Were it not for the kindness of the Educational Department of Upper Canada, in contributing a very superior and extensive collection of mathematical and school apparatus, of Toronto manufacture, the exhibition would have been anything but creditable to our artizans.

The Heating Apparatus.

"The building has been furnished, at considerable cost, with an excellent steam heating apparatus from the establishment of Mr. James E. Thompson, of this city, which has given the greatest satisfaction, affording as it does a sufficient and agreeable heat, and being, in the opinion of the Board, much more economical than any of the ordinary systems of heating.

"RICE LEWIS, *President.*

"GEO. LONGMAN, *Secretary.*"

The Report was adopted, and ordered to be printed for the use of members.

Appendices to the Report.

Appendix A is an analyzed statement of Receipts and Expenditure.

Appendix B is a statement of the Building account, shewing the cost of Building and Furnishing, including cost of Site, to have been $48,380 78. This sum does not include the amount expended by the Government in preparing the Building for the Crown Lands and Post Office Departments.

Appendix C shews the Assets and Liabilities, as follows:—

ASSETS.

Balance cash in hand.........	$93 05	
Members' subscription due...	160 00	
Rents due.........................	116 50	
Value of building and ground	50,000 00	
Value of Library and Furniture..............................	5,700 00	
		$56,069 55

LIABILITIES.

Loan on building & ground	$18,400 00	
Due on contracts and extra work	1,064 02	
Due on General account	306 58	
Discount at Bank	400 00	
		$20,170 60
Balance		$35,980 95

Appendix D is an estimate of Annual Revenue and expenditure, and may be interesting to other Institutes; we therefore give it in full:—

REVENUE.

Permanent and casual Rents	$2,740 00	
Subscription of 900 members @ $2 00, being an increase of 155 on present paying membership	1,800 00	
Yearly and Quarterly Subscribers	400 00	
		$4,940 00

EXPENDITURE.

Interest on loan to Building fund	$1,104 00	
Insurance on Building	120 00	
" Library and Furniture	16 00	
Printing and advertising	50 00	
Binding Library Books	200 00	
Gas	670 00	
Coal and Wood	250 00	
Stationery and Blank Books	50 00	
Postage	84 00	
Subscription to Society of Arts, England	10 50	
Secretary & Librarian's Salary	700 00	
" " Assistant	200 00	
Housekeeper's Salary	400 00	
Repairs to Hall	200 00	
Water Rate	40 00	
Newspapers and Periodicals	300 00	
Contingencies	100 00	
		$4,494 50
Leaving a balance for purchase of new Books		$445 50

The following is a list of Office-bearers and Directors elected for the ensuing year:—

President.................... Rice Lewis.
First Vice President....... Wm. Edwards.
Second Vice President..... Walter S. Lee.
Treasurer...... .... John Paterson.

Directors—R. A. Harrison, Robert J. Griffith, C. W. Bunting, W. H. Sheppard, John Cowan, John J. Withrow, H. E. Clarke, D. G. Carnegie, Wm. Halley, Thos. H. Lee, F. W. Coate and Wm. Hamilton, Jr.

It was resolved on motion of Mr. C. Pearson, "That the Directors be instructed to institute a series of meetings for the discussion of topics of practical interest to mechanics."

Mr. D. G. Carnegie gave notice that, at the next quarterly meeting, he would move the following resolutions:—

1. That the subscription of members be raised to $2 50.
2. That a sinking fund be at once established for the payment of the debt on the building.
3. That the Secretary be instructed to keep a book, to be called "Voluntary Subscriptions to the Reading Room."
4. That steps be taken for permanently establishing certain classes.

After votes of thanks had been passed to the retiring Directors, to the Auditors, to the Ladies who had contributed to and conducted the Bazaar, to the gentlemen who contribute their publications gratuitously to the Institute, and to the Scrutineers of the ballot, the meeting adjourned.

INSTITUTE OF RUPERT'S LAND.

On the 12th February, of the present year, the "Institute of Rupert's Land" was organized at Fort Garry, Red River Settlement. The opening address was delivered by the Lord Bishop of Rupert's Land, who was subsequently elected President.

We hail this formation of the Society with much pleasure, and believe that it will be found a very advantageous medium, through which much valuable information respecting the natural history, physical features and resources of the Northwest Territory will be made public. Subjoined is the Opening Address, which will explain the objects of the Institute, and show its claims to the sympathies and coöperation of sister societies in Canada:—

OPENING ADDRESS.

In assuming the position, which your kindness has assigned to me, I would venture to offer a very few remarks on the nature and object of the Institution we are met together to organise to-day. And before I proceed, I must at once disclaim any exact acquaintance with the higher branches of science: all that I can honestly lay claim to would be a deep and lively interest in the cause, and an extreme veneration for the humblest enquirer in any of its diversified fields. My own University indeed, that of Oxford, has been sometimes considered to be less favorable to scientific pursuits, and it may perhaps be readily allowed, that her highest honors are rather bestowed on distinction in the Ancient Languages and Mental philosophy. But I always recollect with pleasure, that the nobleman, who, at so large an expenditure of skill, toil, and means, has completed the most powerful instrument, ever yet made, for piercing into the depths of space—an instrument which parts and resolves the distant nebulæ, and almost reveals to us new worlds—that nobleman, the Earl of Rosse, is of the University of Oxford. I remember too, that, in the earlier stages of the Royal Society, it was in measure cradled in the same University,* and that a large portion of

* See Hallam's Literature of Europe, p. 575. Its charter of incorporation came a few years later, bearing date July 15th, 1662, exactly two hundred years ago.

its meetings for some years was held within its walls. On more than one occasion also, has the University welcomed the British Association for the advancement of science, so that we may surely infer, that she is ever ready when called upon, to do homage to the cause of science, and give to it all due and suitable encouragement. But this you may feel inclined to acknowledge as natural, thinking that the Universities and Colleges of the olden countries, are the appropriate nurseries of science, its very guardians and keepers Have *we* however, you may still ask, any field for such pursuits—does *our* land, in its present state, offer scope and opportunity for anything of the kind proposed? To this our reply is, others think so. It was only the summer before last, that some passed through the Settlement and proceeded northward — not lured by prospect of gain—not attracted by any dazzling commercial speculation—yet fired, as was obvious to all who met them, with as ardent an enthusiasm, and eager to overcome every obstacle with this one object at heart. They wished, as you will recollect, to gain a spot from which, as they had calculated, they might obtain the best view of a marvellous phenomenon in the heavens * Though ultimately somewhat disappointed in their expectations, theirs was surely a praiseworthy ambition, and you saw in them, that science has her devoted followers, ready to encounter on her behalf any difficulties. The very same summer, I found on my arrival at Moose, that a traveller had preceded me,† and gone along the shores of the East Main, sent chiefly as an Oologist or collector of the eggs of wild birds, by the well known Smithsonian Institution. And we have yet another ‡ in our territory on the Mackenzie River, the Youcan, or the shores of the Artic Sea, who has spent two or three winters in those solitary regions, gathering specimens of the insects of the land for the same scientific body. Besides these, there have been the two fully organised exploratory expeditions—that of the British Government under Capts. Pallisser and Blakiston, with its Naturalist, Geologist and Astronomer, and that of the Canadian Government under Mr. Dawson and Professor Hind, with its, reports carefully drawn up and digested, and the detailed results submitted to the observation of the public. Such is apparently the judgment of others: they survey the land and look into its treasures and find something to reward their labors.

Shall we however think only of strangers—have we no spirit of research among ourselves? There is one present on my right,|| who in the midst of a laborious life, has often stolen hours from rest, looking with curious eye into the minuter secrets of the mysteriesof nature, scrutinizingthe beautifultexture of the insect's wing, or analyzing and examining the wild flower of the Prairie or the Bay. Another too there is holding the same rank in the Hon. Company's service, whose best energies have been given to the cause for many a long year, who has pursued it unintermittingly whether at Martin's Falls, at Norway House, or as I last saw him, full of the one topic, on the shores of Lake Superior. His name, for I allude to Mr. Barnston, is not unknown in Britain as that of a scientific collector, and his contribution of insects from this country may be seen by any in the Entomological department of the British Museum. And we have one more recently come amoug us, who, accustomed to Societies of this description in Canada, has not ceased to press the subject upon us here. It is to the persevering and indefatigable efforts of Dr. Schultz that we are indebted for the present meeting, and I only hope that our zeal may correspond with his warmest anticipations. Let these be sufficient proofs to us that in the busiest life moments may be seized for high and elevated studies—studies which in the solitude of the wilderness carry with them their own recompense.

But may we not gain by combination, and find that union is strength may we not by contagion catch something of this ardour, may we not stimulate others by pointing out to what has already been achieved? Such would be something of our design in laying the foundation of a Scientific Institute. Our object would be threefold: to encourage study—to communicate and diffuse information —and to collect results. To enlarge upon these objects would be unnecessary, and an unwarrantable encroachment upon your time. The casual walk, the tedious journey over land, or the monotonous trip by canoe, might be clothed with interest, if the eye were occupied like the bee, in gathering treasure "from every opening flower," and if each rock overhanging the Lake or lying in the bed of the Rapid, were made to tell its tale. It would be something to learn to use the eye to become the feeder of the mind. The knowledge so acquired in the summer ramble would be the store to be digested, to be shared and diffused abroad during the winter. There would be matter enough for the Lecture to occupy its long evenings, and the desire for information would grow, as the supply become more plentiful and of a better quality. And definite progress would be marked by the accumulation of specimens: and when strangers visited us, we should be able to exhibit to them, in something of shape and order, the vast variety of fowl to be found on our lakes and rivers, and of insects which flutter in the air, as well as some of those minerals (of which we now hear more) to be dug out of the bosom of the earth. In all of these departments too a system of interchange would soon become established: we should act on the principle of giving and taking, and, while sending off some of the products of our own land, we should receive in return some gifts from abroad. My own wish would be to make the basis of our Institute as broad as possible. What a large number of societies effect elsewhere, a single society must, for a time at least, do here. We must, therefore, embrace an extended range of subjects. Natural History would of course occupy a leading place with its almost undefined limits: Botany and Geology would follow, which have now obtained for themselves an independent position,*

* Messrs. Ferrill, Newcome, Scudder, of Cambridge University, Massachusetts, went to a spot near Cumberland House on the Saskatchewan, to take observations of the total eclipse of the sun, July 18th, 1860.

† Mr. Dressler. ‡ Mr. Kennicott.

|| W. McTavish, Esq, Governor of Assiniboia. whose valuable collections of Natural History received the thanks and acknowledgements of the Smithsonian Institution in 1861.

* For some curious remarks on the connection and distinction between Natural History, Botany and Geology, as taught in the Universities of England and Scotland, see an introductory lecture by the Professor of Natural History, Edinbugh, 1855.

and Astronomy would surely present some attractions with our pure and bright atmosphere, and with the still unsolved problem of the Aurora Borealis, inviting a continuance of patient and accurately registered observations.* But we are not inclined to confine ourselves within these boundaries, wide though they may at first appear. With the Indian tribes and all their ramifications and subdivisions we should invite discussion on Ethnology, with the diversified tongues and dialects which these tribes speak, Philology and comparative Grammar would claim attention; while with the vast and varied surface of the continent, and its only partially explored northern boundary, Physical Geography would be naturally a subject of absorbing interest to all. And, if science is to be studied, surely its application to the Arts would be to us of infinite importance, what has been called Technology, and raised to a Professorial chair in one University.† What questions of greater moment can be imagined, than whether the clay of our land cannot be turned to account in the formation of useful ware or of bricks, and whether some native manufactures cannot be introduced and localised among us? To carry out these projects with any success, there are wants which must strike every mind. A Museum would be necessary in which to deposit specimens, preserve them in an enduring form—classify and arrange them. Although this might be done at the commencement in temporary quarters, a permanent building would soon be required. It would, however, be a gain to the whole Settlement for other purposes, and be available for public meetings of different kinds and lectures on general subjects. Curators would be wanted to assort and prepare specimens and to undertake the labour of overlooking the whole collection. I am much mistaken if we cannot find among ourselves one if not more, who has already considerable aptitude and experience in this province. But even the Museum with curators would be comparatively powerless without some of those instruments, by which science carries out her efforts and effects her greatest triumphs. And here I ask your indulgence, while I throw out a suggestion, which I do with the greatest delicacy, yet in the hope that it may not be without some fruit. Might not our Institute furnish a natural and suitable method of commemorating those taken from us—a method beneficial to survivors and likely to carry down the name of the departed to many a distant generation! We have lately lost a Governor, the traces of whose administrative power are unquestionably imprinted on the remotest corners of the land—one who, when the achievement was neither common nor easy, was among the first to effect, at a very high latitute, the journey round the world. What more appropriate memorial of him can we imagine than a Telescope of some power to be placed in the midst of us, through which many might obtain an insight into the wonders of the heavenly orbs? Such a Telescope, to be known as the Simpson Telescope, would surely very appropriately perpetuate the name of the Governor and Traveller, and convey profitable and elevating instruction to many yet to come. And we have since lost another, whose presence we miss to-day, and who would have encouraged us on such an occasion as the present—one ever ready to relieve suffering, and to assist in every way in promoting the public welfare. I was once asked whether we could not have some public memorial of Dr. Bunn, soon after his lamented death, and I expressed my personal willingness to join in any such plan. Now without at all wishing to interfere with those more sacred monuments which affection prompts, I can picture to myself few more successful methods of effecting the desired object, than if his many friends united in presenting to our projected Museum a Microscope of nice and delicate mechanism, as a memorial gift to be inscribed with his name, to reveal to each fresh beholder some of the marvels of Divine power. For these are, after all, the two mightiest agents in discovery, and I see that in this way Sir David Brewster, in his last opening address as Principal to the University of Edinburgh, places them far above the Electric Telegraph or any of the greatest boasts of modern days. This by some may be viewed as practical and personal enthusiasm, on the part of one whose fame rests on Optical Discoveries, but on reflection it would appear to be only the truth. In a similar spirit his accomplished successor at St. Andrew's, Professor (now Principal) J. D. Forbes, had noticed some years before, that "the obscure and doubtful inventors of the compass and thermometer have acquired a firmer title to the gratitude of posterity than even the most gifted improvers in practical science among their successors."* These, then, are the more necessary instruments: others of a smaller size and less costly description would probably be presented by individual well-wishers, so that our apparatus for the prosecution of physical science would gradually grow upon our heads.

Such is a rapid outline of our design submitted for your approval and support. I cannot forbear to add that there could scarcely be a more favourable season than the present for its commencement.

In the Governor of Assiniboia we have one who has himself given abundant proof of devotion to scientific pursuits. More gladly would I have yielded this place to him to-day, as he could have addressed you from his personal experience, while I can only speak as an admirer of science from without. It is, however, no little matter to secure such hearty coöperation and such ready counsel from one in high position and authority.

We are expecting too, within a few days, the newly-appointed Governor of Rupert's Land. May we not entertain the hope that, if invited, he may kindly consent to accept the office of Patron of our infant Institute. We should thus gain his additional weight and influence, and be able through his assistance to obtain observations and contribution from the remotest posts of the Company's service.†

* Regular observations on the Aurora were kept for a number of years at many H. B. Co's posts all over the country, and the Reports transmitted to Col. Lefroy, R.A., then of the Magnetical Observatory, Toronto, under whose direction they were conducted: we do not feel sure if they are still continued.

† In Edinburgh. The first appointment to the chair was that of the lamented Professor George Wilson, M.D., who had succeeded in investing the subject with a peculiar interest and fascination, when cut off by an early death. His services to science are well known.

* The Danger of Superficial Knowledge, 1849.

† Since the above was delivered, a letter has been received from Bernard Ross, Esq., H. B. Co., which shows how much may be

May I add that the very year would stand out as marked by the Great Exhibition of the industry of all nations to take place in May. Though bereft in the mysterious providence of God of its great promoter and originator, in the death of his Royal Highness the Prince Consort, himself the the noblest patron both of science and art, it will, when opened under painfully changed circumstances, serve to show to Britain, to Europe, and the world, that that which is for the benefit of mankind continues long after the mind which planned and designed it may be removed by death. Is it not then, I ask you, a singularly auspicious year for us to commence our humble effort to bring to a focus and centre what the bounteous hand of God has scattered over our land.

Nor have I, in the sacred office which I hold, any fear for the cause of religion from the onward progress of science. A little and superficial knowledge may, as has often been observed, tend to unsettle the mind and leave it a prey to doubt, but a deeper acquaintance with science will ever be found to bring it back again and to bow the soul in adoring wonder before God. We need only point to Newton and Bacon, and among the living, to Heschel and Whewell, to Brewster and Forbes, as examples that the highest attainments in science may be coupled with the reverence and humility of the christian. A more beautiful prayer we cannot have than the Student's Prayer of Lord Bacon, very suitably quoted before students by one already referred to.* "To God the Father, God the Word, and God the Spirit, we pour forth our most humble and hearty supplications, that He, remembering the calamities of mankind, and the pilgrimage of this our life in which we wear out our days, few and evil, would please to open to us new refreshments out of the fountains of His goodness for the alleviating of our miseries. This also we humbly beg, that human things may not prejudice such as are divine; neither that, from the unlocking of the gates of sense, and the kindling of a greater natural light, anything of incredulity or intellectual night may arise in our minds towards Divine mysteries. But rather that by our mind, thoroughly cleansed and purged from fancy and vanities, and yet subject and perfectly given up to the Divine Oracles, there may be given unto faith the things that are faith's. Amen." Thus would man's highest wisdom echo back the confession of the ancient Patriarch, "Lo, these are parts of His ways, but how little a portion is heard of Him"—or the declaration of the great Apostle, "If any man think that he knoweth anything, he knoweth nothing yet as he ought to know."*

In this spirit and with these feelings we launch our little scheme, with more than a trembling hope, with something even of a confidence of success. In the history of the past, adventure and enterprise have generally characterised our land; they are indeed essentially necessary, where the severities of climate interpose so many checks, and where all must for the most part depend on individual exertion. In the northern extremities of the continent, perils of no common kind have been encountered, and the boldest fortitude exhibited, in pursuit of one grand object of search; and in the annals of fame the names of Parry, Franklin and Ross occupy a deathless place. It may be, that as years roll on, and as our country grows in population and wealth and importance, some mead of praise may be accorded to those raised up to gain other triumphs, to increase the social happiness of the community, to add to its stores of intellectual knowledge, and to develop the natural resources of this vast and wide-spread territory.

Our mite towards such a consummation we gladly contribute to-day.

The following officers were then elected:

President.—The Right Reverend Lord Bishop of Rupert's Land.

Vice-Presidents.—Ven. Archdeacon Cochrane, Portage la Prairie; Ven. Archdeacon Hunter, M.A.; Rev. John Black; James Ross, Esq., M.A., Sheriff of Assiniboia.

Council.—Curtis J. Bird, Esq., M.R.C.S., Eng.; Francis Bruneau, Esq., Member of Council of Assiniboia; Thomas Bunn, Esq., Mapleton; Wm. Coldwell, Esq., Editor of the *Nor-Wester;* Rev. A. Cowley, St. Clement's; W. G. Fonseca, Esq., Point Douglas; Donald Gunn, Esq., Cor. Smithsonian Institution; John Harriott, Esq., Chief Factor, Mem. Council of Assiniboia; Hector Mackenzie, Esq., late Arctic Expedition; T. Sinclair, Esq., Mem. Council of Assiniboia; Rev. W. H. Taylor, St. James'; John Inkster, Esq., Member Council of Assiniboia.

Treasurer.—Andrew McDermott, Esq.

Librarian.—W. R. Smith, Esq., Clerk Council of Assiniboia.

Curators.—A. G. B. Bannatyne, Esq., late H. B. Company; Joseph Hargrave, Esq., C.E.; E. L. Barber, Esq., Point Douglas; F. L. Hunt, Esq.' White Horse Plains.

Secretaries.—Wm. McTavish, Esq., F. B. S. C., Chief Factor, Governor of Assiniboia; J. Schûltz, M.D., F.B.S.C., Fellow Medico Physical Society.

His Lordship, the President, then gave notice of the following Papers for next evening:—

On the grammatical construction of the Cree language, by Ven. Archdeacon Hunter, M. A.

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done on the Mackenzie River, and how pleasant is the retrospect of time so spent. Coming at a time when we are so much interested in the subject, Mr. Ross will, I hope, pardon me for venturing to give an extract from a private letter.

Mr. Ross says:—"As the time approaches for leaving this district, I feel rather sorry for my departure from a place where I have spent so many happy years, but I feel that my life has not been passed away uselessly even here. I have contributed in some small degree towards opening up the Natural History and Ethnology of these wild regions, by collection of specimens and by papers published in Scientific Journals. My diploma as member of the Natural History Society of Montreal, I pride above all things, as it evinces that I have not allowed my intellect or amusements to descend to the level of Arctic life in general.

"The Fauna of this district is far larger than any would suppose from its position: the Mammalia comprise about fifty species, all of which are of course residents: the Aves nearly two hundred, of which not above forty remain during the winter. Several rare and a few new species have been discovered."

May such a spirit be found in every post.

* Professor J. D. Forbes.

* We add the following apposite quotation, which has since met our eye as a proof that scientific pursuit is compatible with the highest missionary zeal. "Missionaries ought to be the pioneers, and promoters of science, hand in hand with the Gospel throughout the world. In fact they have been so. And we believe it will be found on close inquiry, that the most efficient labourers in the purely spiritual field, have been on the whole, or on the average of numbers, those who also have done most to shed a brilliant lustre upon the Missionary character and name, in the fields of natural and scientific inquiries, and studies." Review of 'The Chinese classics by Dr. Legge. Evangelical Christendom, Jan. 7th, 1862.'

On some of the more interesting entomological specimens collected at Fort Garry, illustrated by specimens and diagrams, by Gov. Mactavish.

On the nature, extent, and probable value of the upper Saskatchewan, and Peace River gold-fields, (Illustrated by specimens), by Timolean Love Esq.

Sanitary statistics for 1861, with observations on the principal diseases of this Settlement, by John Schültz, M. D.

On the Indian Tribes of Rupert's Land, by James Ross, M.A., Sheriff of Assiniboia.

Mr. Sheriff Ross, seconded by Rev. John Black, moved that the following gentlemen be honorary members: Prof. Wilson, Univ. College, Toronto; Prof. Hind, Trinity College, Toronto; Principal Dawson, McGill College, Montreal; Prof. Lawson, Queen's College, Kingston; George Barnston, Esq., Chief Factor, H. B. Co.; John Rae, M.D., late Chief Factor, H. B. Co.—Carried.

THE ROYAL INSTITUTION AND ITS LECTURERS.

In 1813 Mr. Faraday was appointed Assistant in the Laboratory at 25s. per week, with two rooms. At that time the Royal Institution was renowned throughout Europe for Davy's electro-chemical discoveries.

In 1816 Mr. Faraday's salary was raised to 100*l*. per annum.

In 1825, he was appointed Director of the Laboratory; the funds of the Institution could not admit of an increase of his salary.

In 1833 he was chosen for the Fullerian Professorship of Chemistry by Mr. Fuller. This was endowed with 100*l*. per annum.

In 1853, the amount he received was 300*l*. per annum as Superintendent of the House and Director of the Laboratory.

The electrical discoveries which have been made by Mr. Faraday in the Institution began to be published in 1831, and are not yet ended. His first chemical paper was published in 1816. He has worked long and much for the love of the Institution, and little for its money. For forty years, from 1813 to 1853, his fixed income from the Institution was not more than 200*l*. per annum.

In 1853, Professor Tyndall was elected to lecture on Natural Philosophy for 200*l*. per annum.

In 1859, he received 300*l*. per annum.

Thus the Royal Institution, from being a Society for the promotion of useful knowledge by instruction, became and remains a Society for the promotion of the progress of science by experiment. The amount it has been able to give its professors for either object has been the same. And after sixty years of grand discoveries, including the laws of electro-chemical decomposition; the decomposition of the fixed alkalies; the establishment of the nature of chlorine; the philosophy of flame; the condensibility of many gases; definite electrolytic action; the science of magneto-electricity; the twofold magnetism of matter; the magnetism of gasses; the action of magnetism and electricity on polarised light; and the radiation and absorption of heat by gases and vapours; but little more can be done for the discoverers than was done at the beginning of the century.

Correspondence.

COMMUNICATION FROM MR. WM. WAGNER, AGENT FOR THE CANADIAN GOVERNMENT IN GERMANY.

(ADDRESSED TO W. EDWARDS, SEC. OF B. OF A. & M.)

Cologne, 12th April, 1862.

DEAR SIR,—I renew my thanks for sending to me your Journal regularly, and were it not for your kindness I should be kept here as ignorant of Canadian affairs as the remainder of Germany.

But that you may have a proof that I think of the interests of Canada, I have shipped to your order by the German barque "Mathilde," Captain Rahtgens, from Hamburgh, and may be at Quebec about the end of April or beginning of May, a German Stove for your next exhibition. It is a stove made of strong sheet iron and claded with Chine (Kachelor). The top may be easily taken off, and you will see the inner construction. Between the "Kachelor" and the sheet iron is a filling of fire-brick clay. The stove which you receive is for coal fire. At the same time I have sent another to Ottawa, addressed to George Hay, Esq., Ironmonger. The one sent to Ottawa is for wood.

These stoves cost here at Berlin near $17 50. To import them would be nonsense, but I have no doubt we could import the "Kachelor," or should the stoves be received favourably, then a man could easily be brought to Canada to make the "Kachelor," and set the stoves. I have already received an offer from such a mechanic.

The advantages of these stoves are that they are easily heated, and the heat is kept longer than by our Canadian stoves, and no fear of burning clothing when you come too near them; and it has a better appearance than a blank box stove.

I take the pleasure of making this stove a present to the Board of Arts and Manufactures. Should you like it, and some one would wish to have a stove sent out to Canada, please write to me and it shall be done immediately.

To secure to the oilmen of Upper Canada a place to send it to, I have spoken to different firms, amongst which is one *Mr. Waltjen* of Bremen, who has used Boghead coal, and was last year in Pensylvania—but no person has said anything about Canadian wells. He has received 5,000 barrels from Pensylvania, and now he sends out a relative of his to the oil springs of Enniskillen, either to buy a well or make a contract. Mr. Waltjen, who has a very large establishment, says he will be able to use from 100,000 barrels per annum and more.

He was very happy that I could give him information, and I had to write down all the extracts

from your Journal. This company intends to go up with a vessel to Hamilton.

The question is now, "How deep are the canals between Montreal and Hamilton? What are the expenses to bring a ship through the canals, that is for towing and for lockage, or is this free?" And also please let me know what are the expenses from Wyoming Station to Hamilton, or is it cheaper to go up to Lake St. Clair? All these questions must be understood well to give more information.

To-night I will, at the Mechanics' Institute, give a lecture on Canadian Agriculture, and the Oil Wells of Canada especially. After Easter I will try to bring it before the Berlin public, and also try Holland.

I enclose you a piece of silk dyed by Mr. Waltjen at Bremen.

The sooner I can get an answer from you, the better it will enable me, during the summer, to bring it before this public.

I also believe that I have opened a market for our timber on the Rhine.

From Bremen two ships will load timber, and when I succeed large orders will be given for next winter's work.

The English Consul at Cologne has promised to me his assistance, and I have the best hopes. Emigration will be very good this year. I hear from all quarters that parties are starting—many who have money, some just sufficient with which to reach Quebec.

Is there not a Geography for Canada in existence? If so please send it to me. When you have anything of interest be good enough to send it to me—perhaps your Member of Parliament will send me some pamphlets which shews the developement of Canada.

Please give my card to the Journal, saying that I am willing to transact, or see it done, any business which persons may trust to me, viz., sale of oil, &c., or should any one like to import anything, I will give the information which may be wanted, as long as I am here to take care of Canadian interests.

W. Wagner.

Patent Laws, &c.

BRITISH PATENT LAWS.

From "Synopsis of the Patent Laws of Great Britain and Ireland." Published by the Commissioners of Patents.

"Law, Date, and where Recorded.—Acts 15 & 16 Vict., cap. 83; 16 Vict., cap. 5; 16 and 17 Vict., cap. 115. In operation since 1st October, 1852. See Patent Law Amendment Act, 1852. Great Seal Patent Office, 25 Southampton Buildings, Holborn, London. Price 6d.

"Kinds of Patents.—Letters Patent granted to Natives and Foreigners residing or represented in the United Kingdom. Provisional Protection during six months.

"Previous Examination.—None as to novelty or utility.

"Duration.—Patents granted for fourteen years, but expiring at the end of the third or seventh year, if the requisite payments are not made.

"Government Fees.—£25 for the first three years, £50 for the next four years, and £100 for the last seven years. Provisional Protection converted into Letters Patent at or before the expiration of six months: *Petition*, £5 stamp; *Notice to proceed*, (eight weeks clear before the expiration of six months,) £5; *Warrant and Great Seal* (fourteen days before the expiration of six months), £10; *Complete specification*, £5 stamp.

"Documents required, and where to be left.*—A *petition* to the Queen by the inventor or his agent. A *declaration* of the inventor or his agent, made before a magistrate, or a British Consul abroad. A *Provisional* or *complete specification* (two copies), together with the necessary drawings (two copies). The whole to be left at the Great Seal Patent Office, where also the notice to proceed is to be given, the Warrant and Great Seal are to be applied for, and the final (complete) Specification (in case of Provisional Protection) is to be filed.

"Working and Extension.—Extended by special grant of the Privy Council.

"Assignments.—Registered at the Great Seal Patent Office. Fee, 5s.

"Specifications, Inspection and Copies of.—At the Public Free Library of the Great Seal Patent Office, where also most foreign works on inventions may be consulted, or manuscript translations be had. At the free libraries throughout the country, likewise at the public libraries of the chief continental States, the British Colonies and America.

"Lists of Patents Delivered.—In the Commissioners of Patents' Journal, within a fortnight of the application, within eight days of the notice to proceed, and a fortnight of the sealing of Patents; also in the daily Register at the Public Free Library.

"Specifications Published.—By the Commissioners at cost price, at the Great Seal Patent Office, within a month of the delivery of the Letters Patent. Old specifications published likewise at cost price. In course of publication: Abridgments

* See Rules and Regulations, page 117, of this Journal.

(in classes and chronologically arranged) of all Specifications of Patented Inventions, from the earliest enrolled to those published under the Act of 1852.

"ORIGINALS OF SPECIFICATIONS (Models).—At the Great Seal Patent Office models are not required, but when presented or lent they are deposited in the Museum of the Commissioners of Patents, which is open daily to the public, free of charge."

There is in course of publication, by order of the Commissioners of British Patents, Abridgments (in classes and chronologically arranged) of all SPECIFICATIONS of PATENTED INVENTIONS, from the earliest enrolled, to those published under the Act of 1852.

These books are of 12mo. size, and each is limited to inventions of one class only, so as to enable inventors readily to ascertain if their discoveries have been previously patented or not. At the foot of each abstract are given references to notices of the inventions in scientific and other works, and to the reports of law proceedings for infringements, &c. &c.

The classes already published, and in the FREE LIBRARY OF REFERENCE of the BOARD OF ARTS AND MANUFACTURES FOR U. C., are:

1. Drain Tiles and Pipes.
2. Sewing and Embroidering.
3. Manures.
4. Preservation of Food.
5. Marine Propulsion.
6. Manufacture of Iron and Steel.
7. Aids to Locomotion.
8. Steam Culture.
9. Watches, Clocks, and other Time-keepers.
10. Fire-arms and other weapons, Ammunition and Accoutrements.
11. Papers—Part I. Manufacture of Paper, Paste Board, and Papier Mâché.
13. Typographic, Lithographic, and Plate Printing.
14. Bleaching, Dyeing, and Printing Yarns and Fabrics.
15. Electricity and Magnetism; their Generation and Applications.
16. Manufacture and Applications of India Rubber, Gutta Percha, &c., including Air, Fire, and Water Proofing.
17. Production and application of Gas.
18. Metals and Alloys.

All the above works, with others as they are published, can be obtained at the Great Seal Patent Office; the prices varying from 6d. to about 15s. sterling.

ABRIDGED SPECIFICATIONS OF ENGLISH PATENTS.

2130. H. ATTWOOD. *Improvements in cleaning and in feeding boilers.* Dated August 26, 1861.

These improvements in cleansing boilers, consist in placing one, two, or more conduits at about the water level; the conduits are dished on their upper surface, and are perforated at intervals, while curved flanges are adapted to the sides. Similar conduits are placed at the bottom of the boiler. The improvements in feeding-boilers consist in supplying them from below, through perforated pipes extending along the length, or nearly so, of the boilers. This arrangement is for the purpose of keeping the sediment in a state of agitation, thereby causing the impurities contained in the water to rise to the surface, when it may be drawn off by the scum plate and cock. For some waters chemical agents are used, together with the above mechanical appliances.

2156. R. SHAW. *Improvements in windlasses, capstans, and other machinery for hoisting and lowering weights.* Dated August 30, 1861.

This invention consists in so constructing and arranging the several parts forming the break that it is in operation while the weight is being hoisted, and when it is raised, consequently, if the man at the handle should let it go, the weight remains suspended until the break is released; and by this means the injury and accidents resulting from the man at the handle being overpowered by the weight, or the handle breaking or coming off, are avoided. One mode of performing the invention is by applying one or more palls to the wheel on the drum or other shaft; these palls take into an internal ratchet wheel formed in the break pully, which is surrounded by a friction clip. The details of construction may, however, be considerably varied and modified.

2171. P. TAYLOR. *Improvements in apparatus for removing the sediment from, and preventing the incrustation in, steam boilers.* Dated Aug. 31, 1861.

This consists in applying a pipe to the interior of a steam boiler, which pipe is made with a longitudinal slot or slots extending the whole or the greater part of the length of the boiler, and communicating with an off pipe in which is a discharge valve, capable of being opened and closed rapidly. The valve is of the usual mushroom shape, and in the boss or on the spindle of the valve is a fixed stud; the groove is of such an inclination that, by turning the spindle about one-half round, the valve is opened sufficiently to discharge the sediment, which enters the pipe through the slot or slots above referred to.

2195. E. SUCKOW and E. HABEL. *Improvements in machinery or apparatus for producing a strong blast or current of air.* Dated Sept. 3, 1861.

Here the patentees enclose an Archimedean screw in a cylinder, and give it a rapid rotatory motion. The screw is composed of any number of blades, which are fixed to a conical disc, and have their outer edges revolving nearly at a right angle to projections or catch-rings, fixed to, or forming part of the cylinder. When motion is given to the screw, a strong blast or current of air is produced, similar to that of an ordinary fan, but with a much more powerful effect. They also apply antifriction rollers, when desired, to work against the prepared surface or collar of the shafts in order to lessen the friction.

2298. T. MORRIS, R. WEARE and E. H. C. MONCKTON. *Improvements in batteries, for obtaining electric currents and the products therefrom.* Dated Sept. 14, 1861.

This consists in an arrangement of battery cells, whereby the plates or cells are not immersed, as is

ordinarily the case, in a trough, and whereby the intensity of electricity is obtained more readily, and the electric current is less likely to escape. Also in the mode of producing the chemicals or excitants for the batteries; and also in the mode of making the cells and the divisions thereof; and also of the general arrangement of earth or mineral batteries, and the useful results obtained therefrom.

2328. C. Partington. *Certain improvements in machinery or apparatus employed in the manufacture of paper.* Dated Sept. 18, 1861.

The object here is the separation of the superfluous liquid from "half stuff in order to prepare it for the willow and washing machine." The improvement consists in the employment of one or more pairs of bowls or rollers, supported in a framing, between which rollers the material in the state of half stuff passes, and is pressed until sufficiently solidified for the next operation. The material is fed to the rollers by means of an endless travelling cloth. The upper roller is formed or composed of large discs placed side by side and loose upon the central shaft.

2362. C. Board. *Improvements in veneering presses.* Dated Sept. 21, 1861.

This invention consists in constructing veneering presses in the following manner :—Upon a strong wood or metal frame the patentee lays and secures a sheet or plate of zinc or other metal, on the upper surface of which he fixes metal bars, in such manner that series of chambers or passages extending from end to end of the plate are formed. He places strips of wood or other suitable material at the ends and sides, and he covers the whole with another sheet of metal similar to the first, in order to obtain a smooth and hollow bed on which to perform the veneering. Having formed the hollow bed, he places pipes below it in communication with the end of each of the passages, at one end of which he admits steam, hot air, or hot water, which, travelling along the passages, passes off at the other end. Clamps are fitted to the press, which for convenience, he hinges at one end to the frame.

2363. H. & F. C. Cock. *Improvements in apparatus employed in the manufacture of gas.* Dated Sept. 21, 1861.

This relates to the dip pipe and hydraulic main, the object being to allow for the contraction and expansion, or rise and fall of the ascension pipe, and thereby to prevent the strain upon the joints of those pipes, and mouth-pieces of the retorts.

PATENT LAWS OF CANADA.

We have received the following copy of a Bill to amend the Patent Laws of this Province, as introduced by the Hon. Mr. Moore, on Tuesday, the 6th of May, and set down for a second reading on Wednesday, the 14th of May. Should this Bill become law it will secure many of the benefits asked for in the Memorial of this Board, presented during the present Session, a copy of which is published in this number of the *Journal.*

BILL.

An Act for the Protection of British and Foreign Patentees of Inventions, and the encouragement of Arts and Manufactures.

Whereas it is highly desirable that the inhabitants of this Province should be placed in a position to derive advantage from discoveries in the useful Arts and Manufactures made in other parts of the British Empire, and in the United States and other foreign countries, so far as may be consistent with justice to the parties making such discoveries; Therefore, Her Majesty, &c.:

1. Any person, or the assignee of any person, who has obtained, in Great Britain, or in any of the British Colonies, or in the United States of America or other foreign country, Letters Patent of Invention for any new and useful art, manufacture or machine, or composition of matter, may secure to himself all the privileges conferred by Letters Patent of Invention, issued in this Province under the now existing laws, by causing such Letters Patent so as aforesaid obtained to be enregistered at full length in the office of the Registrar of the Province, within six months from and after the passing of this Act; and any person, or the assignee of any person, who may hereafter obtain in Great Britain, or in any of the British Colonies, or in the United States of America, or in any other foreign country, Letters Patent of Invention for any new and useful art, manufacture, machine, or composition of matter, or any new and useful improvement upon any art, machine, manufacture or composition of matter, may, by causing such Letters so as last aforesaid obtained, to be enregistered at full length in the said office of the Registrar of the Province, within six months from and after the date of such last mentioned Letters Patent, secure to himself all the privileges conferred by Letters Patent of Invention issued in this Province, under the now existing laws.

2. Every such patentee, or assignee of a patentee, for the purpose of causing such Letters Patent to be enregistered in this Province, shall make a written application, signed by himself, or by his duly appointed attorney, to the Minister of Agriculture, and shall transmit to him duly authenticated copies in duplicate of such Letters Patent, and of the specifications, descriptions and drawings attached, or belonging thereto, and shall at the time of his application for such enregistration, pay to the said Minister of Agriculture the following fees, that is to say, the sum of thirty dollars.

3. Letters Patent so enregistered shall be and remain in force in this Province until the expiration of the period for which they have been or may be granted; and such enregistration shall secure to the patentee, or his assignee, during such period, all the rights and privileges that could be secured to him by Letters Patent obtained in this Province under the existing laws, all the provisions of which shall extend to such Letters Patent in as full and ample a manner as if such Letters Patent were granted in this Province under and in virtue of the same; Provided always, that any person who has or shall have purchased, acquired, constructed, or used any machine, manufacture or composition of matter included in such Letters Patent, so as aforesaid enregistered, previously to the enregistration thereof in this Province, shall

be held to possess the right to use, or to vend to others to be used, the identical machine, manufacture, or composition of matter so actually purchased, acquired, constructed, or used by him before such enregistration as aforesaid, without liability to the patentee of, or other person interested in the invention for which Letter Patent so enregistered were, or may have been obtained.

4 The importation into this Province of any machine, manufacture, or composition of matter for which Letters Patent shall have been obtained or enregistered in this Province, shall be deemed an infringement on the rights of the patentee, or his assignee, and if caused and procured by the patentee or assignee himself, shall *ipso facto* have the effect of annulling such Letters Patent so far as regards this Province; Provided always, that nothing herein contained shall be construed so as to apply to the importation by any such patentee or his assignees of one such machine, or sample of such manufacture, or composition of matter to serve as a model or specimen for the making of such machine, manufacture, or composition of matter in this Province.

5. So much of the Act passed in the twelfth year of Her Majesty's reign, intituled "An Act to consolidate and amend the laws of Patents for Inventions in this Province," and of the Act passed in the Session held in the fourteenth and fifteenth years of Her Majesty's reign, intituled, "An Act to enable parties holding Patents for Inventions confined to one section of this Province to obtain the extension of the same to the other section thereof, and for other purposes therein mentioned," as may be inconsistent with the provisions of this Act, is hereby repealed.

6. All patents for inventions which shall be issued in this Province from and after the passing of this Act, shall be for the term of seventeen years; and no renewal thereof shall in any case be granted; and the fees payable thereon shall be for each such patent thirty dollars.

Since the above was in type, we have received a copy of the Bill referred to in the Memorial of this Board, as prepared by the Board of Arts and Manufactures for Lower Canada, and introduced by Mr. Dunkin, entitled, "An Act to repeal certain Acts therein mentioned, and to make other provisions respecting Inventions, Trade Marks and Designs."

The principal features of this Act are, that it provides for the establishment of a Patent Bureau to be attached to the Department of the *President of the Council*, the chief officer of which shall be called the *Commissioner of Patents;* places the citizen of Canada and all other countries on an equality so far as obtaining Patent Rights in Canada; provides that copies of all Specifications, Indices, and Letters Patent, be deposited with the Boards of Arts and Manufactures, respectively, for the inspection of the public; and fixes a tariff of fees slightly in advance of the present charges. Having received the Bill just before going to press, we are unable to give a more lengthy notice in this number; but from the careful consideration it has had by the Lower Canada Board, and the approval heretofore given to it by the Board for Upper Canada, we have every confidence in its being a great improvement on the present Law.

PATENTS OF INVENTION.

Bureau of Agriculture and Statistics, Quebec, 19th April, 1862.

His Excellency the Governor General has been pleased to grant Letters Patent of Invention for a period of fourteen years, from the dates thereof, to the following persons, viz.:—

George Munro, of the Town of Peterborough, Miller, "Munro's Patent Model Grist Mill."—(Dated 29th November, 1861.)

Harry Seymour, of the City of Montreal, Gentleman.—A new mode of preserving wood from the effects of damp or rot to be called "Seymour's system of preserving wood."—(Dated 26th December, 1861.)

Alexander Daniel McKenzie, of Augusta, County of Grenville, Accountant, and Ives Wallingford McGaffey, of the City of Hamilton, County Wentworth, Machinist, "Improvements in Gas Generators and Burners."—(Dated 4th January, 1862.)

Charles Gode Rich, of the Town of St. Thomas, in the County of Elgin, Druggist, "An anti-friction Railroad-Car Box."—(Dated 8th January, 1862.)

Isaac Thompson Pells, of the City of Toronto, in the County of York, Trader, An article known and described as "Baking Powder."—(Dated 9th January, 1862.)

William Arnold Young, of the Town of Dundas, in the County of Wentworth, Last and Peg Manufacturer, "A Boot Treeing Machine,"—(Dated 15th January, 1862.)

David Fleming, of the City of Toronto, in the County of York, Contractor, "A new kind of Farm Fence."—(Dated 15th January, 1862,)

William Arnold Young, of Dundas, in the County of Wentworth, Last and Peg Manufacturer, "An improvement on a Boston Patented Boot Crimping Machine."—(Dated 15th January, 1862.)

Israel Kinney, of the Town of Simcoe, in the County of Norfolk, Waggon Maker, "An improved Churn Attachment."—(Dated 28th January, 1862.)

Arthur Fisher, of the City of Montreal, physician and Surgeon, "A Hollow Brick."—(Dated 7th February, 1862.)

Henery L. Weagant, of Morrisburg, in the County of Dundas, Cabinet Maker, "A Tripod Churning Machine."—(Dated 8th February, 1862.)

John Austin, of the Village of Fergus, in the County of Wellington, Miller, "The Mill Stone Assistant."—(Dated 19th February, 1862.)

Christopher Lockman, of the City of Hamilton, in the County of Wentworth, Machinist, An improvement in Shuttle Sewing Machines, termed "The Family Shuttle Sewing Machine."—(Dated 19th February, 1862.)

William Myers, of the Township of Williamsburg, in the County of Dundas, Mechanic, "A new and Improved Fanning Mill and Machine for separating oats, cockle and other seeds from Wheat."—(Dated 19th February, 1862.)

George Arthur Manneer, of the Township of Innisfil, in the County of Simcoe, Farmer, "A double Lever Power or an improvement to the Lever Powe on Bull Wheels."—(Dated 28th February, 1862.)

Robert Kerr, of the Township of Waterloo, in the County of Waterloo, Yeoman, "An improved grain and seed broad-cast Sower."—(Dated 28th Feruary, 1863.)

Austin Adams, of the City of Montreal, Match Manufacturer, "A new and useful machine for splitting sticks for matches."—(Dated 4th March, 1862.)

William Clouston Robertson, of Belleville, in the County of Hastings, Tailor, "An improved Garment Delineator."—(Dated 8th March, 1862.)

John Wedderburn Dunbar Moodie, of Belleville, in the County of Hastings, Sheriff, "A Rotary Interest Indicator."—(Dated 8th March, 1862.)

James Tomlinson, of the Township of Pickering, in the County of Ontario, Mechanic, "A Steam Coiled Hoop for all kinds of Coopers' work."—(Dated 8th March, 1862.)

Isaac Mills, of the Township of Flamboro' West, in the County of Wentworth, Farmer, "A double and single dash, hinge and crank Churn called 'Mills' Victoria Churn."—(Dated 8th March,, 1862.)

Philip Cady Van Brocklin, of the Township of Brantford, in the County of Brant, Iron Founder, "A new and useful implement called "Van Brocklin's two horse Wheel Cultivator."—(Dated 11th March, 1862.)

James W. Millar and John F. Millar of the Village of Morrisburg, in the County of Dundas, Iron Founders, "An improved Moulding Flask for making the Mould Boards of Ploughs without Sand."—(Dated 12th March, 1862.)

Reuben Watson, Carpenter, and John Overton, Blacksmith, both of the Township of Moore, County Lambton, An improved Plough called the "Lincolnshire Plough Boy."—(Dated 14th March,1862.)

Jarret Smith Clendening, of the Township of Malahide, in the County of Elgin, Waggon Maker, "A portable Clothes Drier."—(Dated 17th March, 1862.)

Charles Boeckh, of the City of Toronto, in the County of York, Brush Manufacturer, "A Lamp Chimney Cleaner."—(Dated 17th March, 1862.)

Edward Trenholm, of Trenholmville, in the Township of Kingsey, in the County of Drummond, Farmer and Miller, "An improved Snow Plough and Flange Cleaner."—(Dated 20th March, 1862.)

Alba Faunce, of the Town of Sherbrooke, in the District of St. Francis, Carpenter and Joiner, "A Vegetable Root Cutter." — (Dated 21st March, 1862.)

Edson York, of the Township of Stanstead, in the County of Stanstead, Carpenter and Joiner, A new and improved Vegetable Cutter called "York's Vegetable Cutter."—(Dated 2nd April, 1862,)

Edson York, of the Township of Stanstead, in the County of Stanstead, Carpenter and Joiner, A new and improved Churn called "York's Rotary Churn."—(Dated 2nd April, 1862.)

Common plumbago, according to recent researches of Dr. Calvert, is composed of 91 per cent. of a subcarbide of iron, 8½ per cent. of a nitride of silicium, with traces of phosphorus and sulphur.

Selected Articles.

GREAT CANDLE MANUFACTORY—DESCRIPTION OF THE OPERATIONS.

A correspondent of the London *Chemist and Druggist* describes the Sherwood Works, at Battersea, England, belonging to the celebrated Price Patent Candle Company. We have condensed the most instructive and interesting portion of this description for the benefit of our readers:—

The manufacture of candles upon an enlarged scale embraces a range of high scientific information. The art has been completely revolutionised within the past thirty years, and for this the world is chiefly indebted to the French chemist, Chevreul, who has now charge of the Royal Dye Works, at the Gobelin manufactory of tapestry carpets, in Paris. Chevreul patiently investigated the nature of fatty bodies, with the view of determining their relative value for illuminating purposes. He found that every natural fat contained substances which ought not to be present in candles, because such substances reduced their illuminating power. Thus tallow is composed of at least two distinct solid bodies, namely, stearic and margaric acids; also a liquid oil—oleic acid and glycerine—a sirupy body, which serves as a base to the three acids. Each of these acids, when burned in the wick of a candle or lamp, gives a more brilliant flame than the tallow from which they are derived, but the glycerine gives a flame which is exceedingly feeble. To obtain a good candle material the latter body must be removed from the fat; and as the presence of oleic acid renders the material soft and greasy, this substance must also be got rid of. Chevreul, in the year 1823, described a process by which the hard acids might be separated. From that time candle making has advanced with rapid strides, and what was once a rude and noisome trade has become a first-class chemical manufacture. To appreciate the difference between the two phases of the art, we need only compare the common parlor candle of twenty years ago with that which now takes its place. The snuffy, guttering, feeble-flamed mold, formed of simple tallow, represents the mechanical stage of candle making, and is rapidly becoming a relic of the dark ages. Instead of it we find in general use, a hard, clean, polished cylinder, composed of beautiful chemical products, which burn away brightly by a slender and snuffless wick. Wax and sperm are still used as formerly, but to a limited extent. A new material, pariffine, has nearly superseded them.

At Price's Candle Works palm oil, cocoa-nut oil, and Rangoon petroleum are used extensively for candles. The palm oil is solid, and comes in casks from Africa. These are emptied in a most expeditious and simple manner. The casks are rolled to a large shed, the floor of which is traversed from end to end with an opening about a foot wide, which is in communication with an underground tank. Over this opening the bunghole of each successive cask is brought, and a jet of steam is made to play upon the solid mass. The heat of the jet speedily melts the oil, which flows out of the bunghole into the tank, whence it is pumped by steam

power to a large pipe, which conveys it to the distilling rooms.

The works cover eleven acres of ground; the distilling rooms are large one-storied buildings, with roofs of corrugated galvanized iron; no furnaces are used; no offensive smell is noticed, and all things look neat and clean, and very different from the filthy fetid candle works that formerly existed. Throughout the factory, steam, either at the common temperature or superheated, is employed as the source of heat in all operations connected with the separation and purification of candle material. The steam is conveyed to the different rooms by suitable pipes, and the smoke, dust and danger of the furnaces are thus kept at a respectful distance.

When the stearic candle manufacture was in its infancy the fat acids were separated from the glycerine by the process called lime saponification. The tallow was first boiled up with thin cream of lime, which seized upon the fat acids and caused them to forsake the glycerine; the soap of lime thus formed was then treated with sulphuric acid, which, by uniting with the lime, set free the fat acids. This was an expensive process, as to each cwt. of tallow 14 to 16 lbs. of lime, and 28 to 32 lbs. of sulphuric acid were employed; moreover, in the candle material, stearic acid, when obtained, was only in the proportion of two parts to five of the tallow employed, and the other product, oleic acid, had little commercial value.

The process of sulphuric acid purification, introduced into the manufacture about twenty years ago, was an immense improvement upon the lime process. It is still employed in these works, though to a comparatively small extent. The quantity of sulpuric acid now employed to decompose 1 cwt. of fat, in some cases is reduced to 4 lbs. and even 3 lbs. Six tons of the raw material, usually palm oil, are exposed to the combined action of concentrated sulphuric acid and a temperature of 350° Fah. The result of this action is very striking. The glycerine is decomposed, and the fat is changed into a mixture of fat acids of a very dark color, with a very high melting point. This is washed to free it from charred matter and adhering sulpuric acid, and is then transferred to a still. When it is exposed to the action of steam the palm oil passes over from the still in a limpid stream, and the product is collected in clean cans, from which it is transferred to tubs. The acid action and the distilling operations separate a dark, bituminous-looking residuum from the pure fatty acids. The sulphuric acid process involves the loss of glycerine and a waste of material, owing to the decomposition of part of the fat acids. These defects induced the chemists of this manufactory to seek for a still more perfect process, and in 1854 such was discovered. This consists in passing superheated steam directly into the neutral fat, by which means it is resolved into glycerine and fat acids; the glycerine distilling over in company, but no longer combined with them. Glycerine, which was formerly looked upon as a nuisance, as something to be got rid of at a great expense, is now valued, and sells at a higher rate than stearic acid. The presence of this body in the tallow candle gives rise to the offensive odor of the snuff when the flame is extinguished.

To obtain the pure stearic acid which forms the beautiful white adamantine candles, the distilled oil is cooled in tubs. When it congeals it is placed in bags of cocoa-nut fiber, and subjected to hydraulic pressure in a room at common atmospheric temperature. In another building is a long line of heated chambers, in which the process of heating is completed. To these the piles of solid acid which have undergone cold pressure are carried, and by a second squeezing, together with the action of heat, every trace of oleic acid is removed from the material. The hard cakes of stearic acid are now removed to large wooden vats, in which they are liquified by steam heat, and the candle material is ready to be run into the molds. Cocoa-nut oils and all solid fats receive the same treatment for making pure stearic acid candles. Common candles are made from the product of distillation before it is subjected to pressure.

Paraffine is obtained for making candles from Rangoon (East India) petroleum, which is similar to that of the oil well of America. This source of paraffine is much cheaper than the heavy oil obtained by distilling cannel coal. The Rangoon petroleum is a natural product of Burmah. It flows out from the ground like the Pennsylvania oil. It is treated to distillation in the Price Candle Works, and separated into different products, according to the temperature at which it is distilled. The most volatile liquid that passes over from the still at 160° Fah. is called Sherwood oil, and is really the benzine, so called, obtained in distilling American well oil. It is used for cleaning kid gloves, and for removing grease from silk and other fabrics. Oil for burning in lamps comes over, when distilled, at a higher temperature, then heavy oil for lubrication, at a temperature of about 550° Fah., and lastly paraffine, at 620° Fah. When cooled and solidified, by its temperature being reduced with ice, it forms the most beautiful known material for candles except white wax. In distilling this substance from petroleum, superheated steam is employed in order to elevate the retort to the proper temperature. Paraffine is subjected to pressure in the same manner as the solid fatty acid, obtained from palm oil and tallow. It is a beautiful white substance, and has a silvery luster. It is melted with steam heat, and run into molds in the usual way. In many cases great trouble has been experienced in removing stearic acid and paraffine candles, after they had become solidified, from their molds. In this manufactory a most convenient and ingenious method of removing them is employed. It is simply the force of compressed air. There are several large iron tanks, in which compressed air is forced by a steam engine; and these tanks connect with the machine in which the candles are molded. The candle molds are arranged in benches. Along the top of each bench there is a little railway, on which runs the "filler"—a car containing hot candle material. The wicks having been adjusted truly in the molds, the filler advances and drops in each mold the requisite amount of material. After a sufficient time has been allowed for solidifying and cooling, the boys who attend the machines proceed to remove the candles from the molds. It is in this operation that the compressed air is made use of. Each mold is connected with the reservoir, and on merely

opening a tap, pop goes the candle, which is dexterously caught by the boy.

The candle molds and air pump constitute an immense air gun, containing a stock of several thousands of barrels, each loaded with a candle. The turning of a cock by boys in attendance lets off these guns, and eject the candles with a slight hissing noise. This fusilade is going on all over the room, throughout the entire day, and in the course of ten hours no less than 188,160 candle projectiles, weighing upwards of 14 tons, have been shot forth.

Innumerable contrivances for drawing candles have been attempted, but none equal this, as the compressed air does not injure the fine polish of the molds on which the beauty of the candles greatly depends. The tops of the candles are downward when molded.

Eight hundred operatives, consisting of men and boys, are employed in this establishment. The wicks for the candles, and the cocoa-nut fiber bags are woven on the premises. There is a school for the boys, and a large space of ground allotted for them as a gymnasium. There is also a large swimming bath and an excellent library.—*Scientific American*

SPEED OF TRANSMISSIONS IN LONG TELEGRAPH CABLES.

Three elements are concerned in producing the retardation of telegraphic signals, the copper conductor, the insulating sheath, and the earth.

The copper conductor, if constant throughout its whole length, possesses a power of conducting the electric force in simple proportion to its thickness, and in inverse proportion to its length.

This conductor, when surrounded by a substance of a comparatively non-conducting or insulating quality like gutta-percha, becomes a leyden jar; and in this state Professor Thomson has shown that the capacity of the copper for receiving what is called the charge, or in other words, its electro-state capacity, by which the rate of signalling is effected, depends on the *ratio* of the diameter of the gutta-percha, to the *ratio* of the diameter of the copper, being at the same time independent of the *absolute* diameter of either.

This electro-static or retarding influence, however, only manifests itself while the insulating sheath of the conductor is in contact with the earth, shewing that the loss of speed in transmission arises simply from the increased induction derived from that contact, owing to the inductive capacity possessed in a superior degree by gutta-percha over the same capacity in air, which is the surrounding medium of the conductor in the case of land telegraphs. This is shewn by the fact, that if a copper wire insulated along its whole length with gutta percha, be suspended in the air, it will be found to have lost nearly all its inductive tendency, which, however, will be rapidly restored to it when laid again in earth or immersed in water.

This, then, being the state of facts as regards the conducting power of the copper, the inductive capacity of the insulator, and the influence of contact with earth or water, it is manifest that the rate of charging and discharging a cable—which is the main circumstance affecting its speed of transmitting messages—must depend, first, upon the size of the conductor, by which is determined the quantity of electric force that can be thrown into the line with advantage at one blow; and, second, to the ratio of insulation applicable to the diameter of that conductor, so as to reduce to a minimum the influence of inductive absorption.

It will thus be apparent that whatever the length of cable required to be laid, the speed at which it shall work may be determined to a nicety; indeed, the whole thing has been tabulated in a most convenient form by Mr. Varley, shewing from practical results the capacities of gutta-percha for inductive absorption from one to 350 layers, and it is clear that within comparatively reasonable limits, as to expense of materials, the induction may be decreased and the speed increased to any useful extent.

It is true that by increasing the circumference of the copper wire, the surface for inductive action is increased also; but inasmuch as the induction is merely superficial, and increases only as the circumference of the copper, while the conducting power of the latter increases as the square of its diameter, it is manifest that the gain to conduction goes on increasing with the size of the copper in an enormous ratio, and as stated by Mr. Varley, "if the wire so increased in size be coated with insulating material to such a thickness as shall give the same induction as the former or smaller wire, the result will be that four times the speed will be obtained."

Nor must it be supposed that in order to attain a comparatively high speed along a cable 2,000 miles in length, it would be necessary to increase the quantity of material and consequent expense beyond what would be equally desirable and economical in a line divided into sections, varying from 300 to 900 miles each. The quantity of copper and gutta-percha employed in making the core of the cable, now suggested by Glass, Elliot & Co., to the directors of the Atlantic Telegraph Company, to be laid between Ireland and Newfoundland, is to be 510 pounds of the former to 550 pounds of the latter. This cable has been certified by electricians, whose opinions are unquestionable, to be capable of working at the rate of eight to twelve words per minute. If we take the mean at ten words, and refer to Mr. Varley's evidence before the Board of Trade Committee, we shall find that if the Atlantic cable can be made to speak at that rate, it will not, in speed at least, be very far behind even the land telegraphs of this country. Mr. Varley, who is at the head of the Electrical and Engineering Department of the Electric and International Telegraph Co, says, respecting the working of land lines:—"In practice, we seldom work on the English lines at a higher rate than twenty-two words per minute. An entire hour's work will seldom shew a higher speed than twelve or fifteen words per minute."

If this be so, and if the direct Atlantic Telegraph line be able to work at 8 words per minute, how is it possible that a line of upwards of 3,000 miles in length, from London to the confines of Labrador, working in four sea sections, whose lengths of cable are respectively 270, 360, 720, and 960 miles, with the retardation due to these sections, and the impossibility of using relays, at all events, on the

longer sections, can transmit messages at the rate of nine times faster, or, indeed, any faster than the direct Ireland to Newfoundland cable. The fact is, that a very large staff would have to be kept at the terminus of each section, and every message would at each terminus have to be read off, and re-transmitted to the terminus of the next section, and thus every message and signal would have to be repeated eight or nine times at least during its transit from London to New York, and the result would be that, with all its apparent advantages of short circuits, it is very problematical whether intelligence could be sent to America by the northern route even at as good a speed as by the direct Atlantic cable properly constructed and laid.—*London Mech. Magazine.*

GOVERNMENT AID TO SCIENCE IN ENGLAND.

The following statement of the sums paid for scientific objects, or to scientific men, by the government, is taken from the "Civil Service List" for March, 1860:

Royal Mint—Master and Worker	£1500
Science and Art Department—Secretary and Superintendent	1200
" " Assistant Secretary	775
Queen's College, Cork—President and Director of Irish Museum	1200
Director General Geological Survey, and Director of Geological Museum	1100
Astronomer Royal ... ... House and	1000
British Museum—Superintendent of Nat. Hist. Department	800
" Keeper of Zoology	500
" Keeper of Mineralogy	500
" Keeper of Botany	500
" Keeper of Geology	500
Director of Kew Botanic Gardens	800
Registrar of London University	800
Superintendent of Coining	700
Woolwich Arsenal—Chemist	700
" Assistant	280
Inland Revenue Laboratory—Principal	600
" Assistant	300
Queen's College, Belfast—Vice President	500
Superintendent of Nautical Almanack	500
School of Mines—Lecturer on Chemistry and Chemist	300
" Lecturer on Physics	200
India Office—Reporter on the Products of India	500
School of Mines—Lecturer on Natural History, and Naturalist to Geological Survey	625?
School of Mines—Lecturer on Geology, Local Director of Geological Survey	550?
Geological Survey, Ireland—Local Director, Lecturer on Geology, Museum of Irish Industry	650?

The following summary of the sums required for the Department of Science and Art for the years ending March 31, 1861 and 1862, shows well what the Government now does as compared (not with the time when the Royal Institution was founded, but) with the year 1843, when the Grant commenced with £2,008 for the Museum of Economic Geology:

	1861–2.			1860–1.		
For General Managament in London	£4,705	0	0	£4,560	0	0
For Schools of Art and Science in the United Kingdom, South Kensington Museum, Library, &c	76,405	0	0	77,415	0	0
For School of Mines, and the Geological Museum, Jermyn St. London	6,387	2	6	6,417	2	6
For Geological Survey of the United Kingdom	10,798	1	6	10,317	19	6
For Industrial Museum for Scotland, including the Natural History Museum, Edinburgh	1,931	12	0	1,943	16	0
For Royal Dublin Society	6,000	0	0	6,000	0	0
For Museum of Irish Industry and Provincial Lectures in Ireland	4,956	16	0	4,996	16	0
Royal Hibernian Academy	300	0	0	300	0	0
	£111,483	12	0	£111,950	14	0

The sums actually expended in the year ending March 31, 1861, for Scientific Education and connected matters, and National Collections, were £221,851:—

British Museum	£92,800
National Gallery	10.348
Scientific Works and Experiments	3,488
Science and Art Department	97.472
Museum of Practical Geology	6,705
* Royal Society	1,000
Geographical Society	500
Portrait Gallery	1,538

The extension of education in Natural knowledge, since the founding of the Royal Institution, is also shown by the changes which are taking place in the Universities and Schools quite independently of the Government.

In the University of London degrees have been granted in Natural Knowledge since 1860.

At Oxford there are Professors of Chemistry, Physics, and Geology, receiving now a fixed income of £310 each, which it is proposed to increase to £400 yearly.

There is a Professorship of Natural Knowledge at Magdalen College, which soon will receive £600 yearly.

The Linacre Professor of Physiology will soon be paid, by Merton College, £800 yearly.

At Cambridge, a Chemical Laboratory has been opened at St. John's College; £150, with the fees are given to the Director, who is a Fellow of the College.

And the Professorships of Chemistry, Anatomy, Botany, Geology, Mineralogy, and Mechanics, have recently been raised to £300 a year each, besides fees for lectures, the amount of which varies.

COMMERCE AND TRADE OF THE LAKES.

Statement of the tonnage of the North-Western Lakes and the St. Lawrence River, as compiled from the Marine Register of the Board of Lake Underwriters.

UNITED STATES TONNAGE.

Description.	Number.	Tonnage.	Value.	Men.
Steamers ...	71	40,125	$1,493,300	1,775
Propellers...	182	56,503	2,597.100	3,640
Barques......	44	18.331	447.300	528
Briggs........	70	20.613	407.600	770
Schooners ..	789	174,015	4,496,800	7,890
Sloops........	10	345	5,750	40
Total...	1,166	309,632	$9,447,850	14,346

CANADIAN TONNAGE.

Description.	Number.	Tonnage.	Value.	Men.
Steamers ...	76	24,544	$1,175,600	1,900
Propellers ..	21	4.748	207,800	420
Barques......	18	6,787	189.500	216
Briggs........	16	4,258	93,500	176
Schooners ..	200	30,885	752,100	2,000
Sloops........	5	283	6,100	20
Total......	336	71,505	$2,414,600	3,732

TOTAL U. S. AND CANADA TONNAGE.

Number of vessels	1,502
Total Tonnage	381,137
Total value	$11,862.450
Total number of men	18,975

It will be seen by the above that the United States tonnage exceeds that of Canada as follows:—

Excess in the number of vessels	830
Excess in the amount of tonnage	238,127
Excess in value	$7,033.250
Excess in number of men	10,911

VESSELS BUILDING IN 1862.

Below we give the number of United States and Canada vessels now building on the North-Western Lakes and the St. Lawrence River:—

UNITED STATES VESSELS BUILDING.

Rig.	Number.	Tonnage.	Value.
Steamers	3	1,700	$119,000
Propellers	22	8,210	574,700
Sail	32	21,049	947,205
	57	30,950	$1,640,905

* See subsequent Note.

CANADA VESSELS BUILDING.

	Number.	Tonnage.	Value.
Steamers	1	410	$28,700
Sail.................	7	3,450	136,800
Total............	8	3,860	$165,600
Present United States tonnage...	1,168	309,632	$9,447.850
Vessels building....................	57	30,959	1.640.905
Present Canada tonnage..........	336	71.505	2,414.600
Vessels building	8	3,150	165,500
Total of all kinds......... ...	1,567	415,546	$13,668,808

EXPORTS OF THE PRODUCE OF CANADA IN 1861.

	Great Britain.	B. N. A.	U. S.	Total.
Produce of the mine.........	£400	——	——	£400
Produce of the fisheries.....	1,310	——	£5.728	7,038
Produce of the forest........	762.178	£2,169	75.867	840.214
Animals, their products ...	631,091	54,103	292,448	978.810
Agricultural products......	7,877.959	335.728	284,507	8,502.063
Manufactures	58.496	7,003	18.189	83,688
Other articles..	2,008	——	1 526	3,534
Total value of exports, '61...	9.333.442	399,003	678.265	10,415,758
" " '60...	4,868,893	202,440	943,552	6,020,715

These figures show an increase in the aggregate of the value of the exports of nearly 100 per cent. over 1860, and this, too, notwithstanding the falling off in the exports to the United States, and which, compared with the previous year, shows a decrease of about 40 per cent.

PETROLEUM.

Nothing has given us more satisfaction for some months past than to record from time to time the additional sources of petroleum which have been discovered in Canada and elsewhere. It appears after all that the importation and distribution of this substance in this country is not an unmixed blessing. Petroleum cannot be transported, bonded and handled, unaccompanied with danger. On Friday last a deputation from some of the principal fire insurance companies in the metropolis waited, by appointment, upon the Lord Mayor, at the Justice-room of the Mansion-house, with the view of bringing under his notice this subject. The gentlemen composing the deputation were Mr. Lovell, secretary of the Phœnix; Mr. Sidney J. Fletcher, secretary of the Sun; Mr. Thomas B. Bateman, representing the London; Mr. John B. Johnston, secretary to the Royal; and Mr. John Atkins, of the Liverpool and London Fire and Life Insurance Companies. Mr. Lovell said they had sought the interview to call particular attention to this new product, which was being very largely imported into this country, and particularly the metropolis, which was likely to be still more largely imported, and which contained an element of danger unknown to any other substance. Petroleum was in the highest degree combustible, and threw off an inflammable explosive vapour at ordinary temperature, and even at a very low temperature. On Thursday, which was a cold wet day, it ignited on a light being held to it an inch from the surface. It floated upon, and would not mix with water, and therefore water would not extinguish it. It was exceedingly volatile, and spread rapidly over the surface of water, burning fiercely when ignited. From statistics in possession of the fire-offices, it appeared that there were now lying at one wharf alone on the Thames, 7,000 casks, containing 210, 000 gallons of this extremely inflammable oil; at another place 3,000 barrels, each barrel containing 46 gallons. These had been landed from one single ship, and if any fire should approach this mass of inflammable and explosive fluid, shipping on the river and property along its banks and in the docks would be placed in jeopardy, and the most disastrous results might occur.

Mr. Lovell said the deputation had taken the opinions of Dr. Letheby, Mr. Miller, of King's College, and Mr. Warrington, of Apothecaries'-hall, with regard to the substance in question. Dr. Letheby reported to them that:—"The raw petroleum gives off inflammable vapour at ordinary temperature, and this is explosive when mixed with atmospheric air, and will fire at a distance of an inch and a half from the surface of the liquid. The specific gravity of the liquid is 808·6, water being 1,000' and it boils at 212, rising to 266 of Fahrenheit." Mr. Miller stated that:—"The brown sample labelled 'crude' when poured into a shallow dish, of a temperature of 60 Fahrenheit, takes fire on the approach of a light, the vapour taking fire at an inch or more from the surface of the liquid. This crude oil is somewhat lighter than water, and consequently floats upon it. When poured upon water at 60°, it takes fire on the approach of a light to within about an inch of the surface and burns with great violence. If a teaspoonful of the oil be poured upon a saucer full of water five inches across, on setting fire to it the heat evolved as it burns is sufficient to make the water boil briskly at the surface. I have no hesitation in saying that I do consider such storage in the highest degree dangerous for the causes above-mentioned, and I think that stringent measures should be at once taken to prevent it." Again, Mr. Warrington reported that:—"Raw petroleum has a specific gravity 812 and gives off inflammable vapour continuously at the ordinary temperature of the atmosphere—58 to 60°. In these experiments the lighted match was held about half an inch above the surface of the liquid under trial. As both fluids are lighter than water, and are not mixable with it, they will necessarily float upon its surface without any modification of their properties." Mr. Lovell added, that about a quarter of a million of gallons was stored in the Isle of Dogs in the crude state, which, as had been shown, was highly inflammable. Mr. Lovell enquired of the Lord Mayor whether he could not interfere in the matter. The Lord Mayor said, as chairman of the Board of Conservators of the Thames he had no judicial functions, but as chief magistrate of the city of London, if they brought before him a case where there was any great quantity of this material deposited within his jurisdiction, it would probably be competent for him to interfere in the public interest, because there could be no doubt whatever, if what Mr. Lovell had said was an accurate representation of the facts, that the knowledge of such great quantities of inflammable matter being stored in any particular place would naturally excite terror in the minds of the people whenever the circumstance became known, and that on the authority of Lord Campbell in "the Queen v. Lister and Biggs" (Crown Cases Reserved), the law would justify a prosecution. It appeared to him that some law might be enacted, prohibiting its being accumulated together in large quantities in casks, and

generally regulating its care and stowage. The storing of gunpowder, materials for fireworks and the like, except under particular conditions and at certain prescribed distances from inhabited places, was especially prohibited by statute; and although petroleum, being until recently an unknown substance, could not be included within the prohibition, yet, as he was advised, the common law would interpose, as in the case of naphtha, to prevent its being deposited in such quantities or in such circumstances as to endanger life or property. It seemed to him that it would not be desirable to put any law into execution, which might discourage the importation of this article. It appeared to be a gift of Nature, and we ought gladly to avail ourselves of its introduction; but it would be for the Legislature to regulate its introduction and use, accompanied as these were with a great element of danger.—*Mechanics' Magazine.*

THE ATLANTIC TELEGRAPH COMPANY.

The following is a description of the cable just submitted by Messrs. Glass, Elliot and Company to the Atlantic Telegraph Company as the one they would propose to lay, and to a considerable extent to guarantee, as to working efficiency, between Ireland and Newfoundland, requiring a length of 1900 nautical miles.

The electrical conductor is composed of seven copper wires, each $\frac{1}{16}$ inch diameter and laid into a strand rendered perfectly solid by the six outer wires being embedded in Chatterton's Compound upon the centre wire. The conductor weighs 510 pounds per nautical mile, and is calculated to transmit under the *old* system of working 22 letters equal to $4\frac{1}{2}$ words per minute, but is certified by Mr. C. F. Varley to be capable of being worked by means of recent improvements at the rate of 60 letters, or 12 words per minute, between Ireland and Newfoundland.

The conductor is insulated by eight coatings, four of the purest gutta-percha, and four of Chatterton's compound, laid on in alternate layers, forming together a thickness of $\frac{3}{16}$ of an inch from the centre; the external diameter of the whole cable being $\frac{9}{16}$ of an inch, weighing with conducter 1060 pounds per nautical mile.

It is proposed to do away with the tarred hemp hitherto surrounding telegraphic cores, and as a protection to the core, to use strands consisting each of three best charcoal iron wires, gauge, ·055 each strand being separately covered with Chatterton's compound and gutta-percha to prevent decay. These coated strands, thirteen in number are then laid around the core spirally by the usual machinery, and the finished cable passes out of the covering machine into tanks filled with water, there to wait till the whole length required is ready for shipment, water tanks will also be provided on board ships so that from the very infancy of the cable to its final submersion, it will be continuously every moment under tests of the most certain and delicate description.

The dispensing with the tarred yarn hitherto in use, renders the instant detection of any flaw in the gutta-percha core, an absolute certainty. These were often temporarily concealed by the wrapping of tar which is to some extent an insulator, and only broke out after the cable had been laid and worked through for some short period. Every part of the external surface of the cable being thus also of a nature quite indestructable in and impervious to water, there is no fear of deterioration either before or after submersion and none of the original strength being lost by decay, it would be possible to lift this cable if required even from very deep water.

Miscellaneous.

Red Sea Telegraph.

So much has been said about the instability of submarine lines laid in comparatively shallow water that the raising of this wire, was looked forward to with considerable interest; yet, when brought to the surface, even after having been subjected to the action of the waves over the coral rocks for three years, it was found to be but slightly altered in outward appearance.

A close examination showed that in some places the wires were corroded slightly, but still the black coating of mud and oxide with which it was covered so closely resembled tar that it seemed at the first glance impossible to believe that the wire had been down more than a few months. The Gabari then continued to underrun the line till within a mile and a half of Jubal Island, and the accounts state that it is difficult to imagine anything more beautiful than the mass of zoophytes, of every tint and colour, which had cased round the whole cable to the thickness of several inches. These being mostly of a soft tenacious nature would tend most materially to preserve the outside iron wires from decay. On the 26th the Gabari underran the shore end of the cable to Cosseir, in order to remove it and lay it to Jubal Island. Though the portion of this line had only been down some 14 months, yet it was found on raising to be completely encased in a protecting sheath of coral and zoophytes.

Rock Oil in Shropshire.

Mr. G. Shepherd, C. E., is of opinion we have an abundant supply of paraffine in England, which can be obtained at a cheap rate. In the Shropshire iron districts, he says there is a rock known to the miners as the "stinking rock;" this rock yields a great deal of mineral tar; it is found in sinking to the coal and ironstone, and it is many feet thick.

Safety Matches.

The consumption of lucifer matches in this country, at a moderate estimate, exceeds fifty millions daily. This fact alone sufficiently indicates the importance of an invention by Messrs. Bryant and May, of the Safety Match Works, Fairfield Middlesex, the primary effect of which is to lessen the danger of fire—arising from the use of an article indispensable requisite in every household—whilst it also protects the health of thousands, chiefly children, employed in this branch of industry. The "special safety" of the patent match is that it cannot be ignited by friction, except on the prepared surface of the box, whilst (as is well known) all other lucifer matches not only can be ignited on any hard surface, but combustion frequently occurs

from accidental and apparently trifling causes. It has been said that those employed in making ordinary lucifers, are liable to a frightful and inveterate disease, known as " necrosis " caused by the fumes of the phosphorus used in their manufacture, which attacks the jaw-bones—the lower being sometimes entirely destroyed. As the safety match contains no phosphorus, all risk of this distressing malady in its manufacture is effectually prevented. A source of fires (attributable to the use of lucifers) arises from the number of matches, which, not readily lighting, are thrown away, whilst in most cases their combustable properties remain, and, by being trodden on, and in various other ways, the latent fire is evolved, possibly causing a conflagration. This cannot happen with the " safety match," which affords an instantaneous light, as readily as those in common use, whilst all danger of accidental fire is avoided.

Modern Projectiles.

Comte de Latour, says that the opinions now generally held regarding the power of the new fire-arms are vastly exaggerated, and shows that many more men were lost in the great battles of the empire than in the last Italian campaign. At Austerlitz, the Russians lost 30 per cent., the Austrians, 44 per cent. of their army; the French lost 14 per cent. At Wagram the loss of the Austrians was 14, that of the French 13 per cent. At La Moskowa, the Russians lost 44 per cent.; at Waterloo, the allies lost 31 per cent.; the French 36 per cent. At Magenta, on the contrary, the Austrian loss was not more than 8 per cent., that of the French only 7; at Solferino, the Austrians sustained a similar loss, and the Franco-Sardinians only lost one-tenth. This may be explained by the fact that a long range obliges the projectile to describe a curve; thus, according to M' d' Azemar, if the column of the Place Vendome were placed between the gun and the mark, the latter being at a distance of 2,500 yards, the projectile would pass clean over the monument without touching it.

Water converted into Fire

There have been speculations as to the possibility of such a transformation for a long time. But in a recent number of the *Cosmos*—a scientific journal, of a high character, published in Paris—the Abbé Moigno, the editor, informs his readers that he has seen this at the workshop of the discoverer, M. Festud de Beauregard, in the Rue Lafayette, and that the action and the effects are truly admirable. It has long been known that when oxygen and hydrogen gases unite and form steam, as they do by their union, a most intense heat is produced. In this case, in fact, we have the oxyhydrogen blowpipe, which though very small, is yet a furnace of the most intense heat. It is now found that by exposing steam in its turn to a very high temperature, the atom of oxygen and the atom of hydrogen (of both of which in union with each other, an atom of steam consists) tend to separate again, and in fact may be actually separated merely by presenting to the very hot steam some substance with which one of the elements of the steam, either the oxygen or the hydrogen, tends to unite rather than the other. But no sooner are the oxygen and the hydrogen separated than they tend to rush together again, producing in the act of union the heat of the oxyhydrogen blowpipe. In order to obtain this wonderful power of heat all that is necessary, as now appears, is to raise steam to a very high temperature, and then to let it loose when very hot upon some body which tends to unite with one of its elements, its oxygen for instance, as is the case with common fuel. The hot steam immediately sets the fuel on fire. M. Moigno mentions that in the apparatus which he saw, a jet of hot steam from a tube, which was only one millimetre (about 1-25th of an inch) in diameter, when made to play upon a mass of charcoal in a furnace, lighted it up into a most vivid fire. The only point that is staggering is the immense heat which requires to be imparted to the superheated steam. Thus, for the full effect, 1000 deg. cent. is named,—that is, 1832 deg. Fahr.—that is, a heat at which silver and almost copper melts. And this said to be produced by having the steam-heater immersed in a bath of melted tin. As there is no need of great pressure however, and no risk of explosion (for no water at all is admitted to the steam-heater), it may be found possible both to command and to control steam at this temperature with economy upon the whole. And if so, there can be no doubt that not only in the laboratory of the chemist, but in the reducing of metals and in the arts generally, on a great scale, the application of superheated steam will form an epoch.

Deleterious effects of Copper.

Dr. Perron, of Besancon, where there are more than 3,000 persons engaged in the manufacture of watches, in his paper adverts to the mischief which accrues from the constant manipulation of copper. His conclusions are as follows:—1. The molecular absorption of the salts and oxides of copper give rise to gastric irritation, diarrhœa, fever, &c.—in fact, to the symptoms of poison all but in degree. 2. Successive slow poisonings of this kind derange the health of the workman, and powerfully predisposes him to phthisis (a disease of frequent occurrence among the Besancon watchmakers). 3. They require him to take corporeal exercise, carried even to fatigue, and justify the frequent employment of evacuants and sudorifics. 4. Manipulations of copper or other metals should be interdicted to thin and excitable persons of a dry bilious temperament, and who have any congenital or acquired disposition to phthisis. 5. This affection is best prevented by the use of succulent aliments, and tonic drinks, the thorough ventilation of the workshops, great cleanliness, frequent tepid bath, and wearing the moustache.

Native Woods at the Great Exhibition.

Among the articles to be sent to the Exhibition from the island of Dominica, in the West Indies, are no less than 170 varieties of native woods, principally hard and susceptible of a fine polish. Indeed the specimens of wood from our various colonies, manufactured and in the rough, will form to a large and influential body of the British community one of the most interesting sections of the palace of arts and industry.

Drift of the Sea.

A bottle has been picked up at sea, off the Azores Islands, which, from a memorandum it enclosed, had drifted 1,417 miles in 243 days, equal to 5.83 miles per day.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

JUNE, 1862.

THE INTERNATIONAL EXHIBITION.

OPENING OF THE INTERNATIONAL EXHIBITION OF 1862.

The State opening of the International Exhibition of 1862 took place yesterday, and was in every respect a great success. The Commissioners appointed by Her Majesty to conduct the ceremony were:—His Royal Highness the Duke of Cambridge, K.G., His Grace the Archbishop of Canterbury, the Lord High Chancellor, the Earl of Derby, K.G., the Lord Chamberlain, Viscount Palmerston, K.G., G.C.B., and the Speaker of the House of Commons.

Address of the Royal Commissioners and Reply.

When His Royal Highness and the other Commissioners had taken their seats, Earl Granville said:—

"In the name of the Commissioners of the International Exhibition of 1862, I have the honour to present to your Royal Highness, your Lordships, and Mr. Speaker, our humble address to Her Majesty. In it we respectfully offer our condolence on the irreparable loss which Her Majesty and the nation have sustained, and we express our gratitude to Her Majesty for having appointed your Royal Highness and your colleagues as Her Majesty's representatives, and we thank the Crown Prince of Prussia and Prince Oscar of Sweden for their presence on this occasion. In it we describe the rise and progress of the Exhibition, and the manner in which we propose to reward merit. We express our thanks to the Foreign and British Commissioners who have aided us in the work, and we express a humble hope that this undertaking may not be unworthy to take its place among the periodically recurring exhibitions of the world."

Lord Granville then handed to the Duke of Cambridge the following address, of which his speech was a brief summary:—

"May it please your Royal Highness and my lords Commissioners:—

"We, the Commissioners for the Exhibition of 1862, humbly beg leave to approach Her Majesty through you, Her illustrious representives on this occasion, with the assurance of our devotion to Her Majesty's throne and Royal person.

"And first of all it is our melancholy duty to convey to Her Majesty the expresssion of our deep sympathy with Her in the grievous affliction with which it has pleased the Almighty to visit Her Majesty and the whole people of this realm in the death of Her Royal Consort. We cannot forget that this is the anniversary of the opening of the first Great International Exhibition 11 years ago by Her Majesty, when His Royal Highness, as President of the Commissioners of that Exhibition, addressed Her Majesty in words that will not be forgotten. After stating the proceedings of the Commission in the discharge of their duties He concluded with a prayer that an undertaking 'which had for its end the promotion of all branches of human industry and the strengthening of the bonds of peace and friendship among all nations of the earth might by the blessing of Divine Providence conduce to the welfare of Her Majesty's people, and be long remembered among the brightest circumstances of Her Majesty's peaceful and happy reign.'

"When we commenced our duties, and until a recent period, we ventured to look forward to the time when it might be our great privilege to address Her Majesty in person this day, and to show Her Majesty within these walls the evidence which this Exhibition affords of the soundness of the opinion originally entertained by His Royal Highness—evidence furnished alike by the increased extent of the Exhibition, by the eagerness with which all classes of the community have sought to take part in it, and by the large expenditure incurred by individual exhibitors for the better display of their produce and machinery. We can now only repeat the assurance of our sympathy with Her Majesty in that bereavement which deprives this inaugural ceremony of Her Royal presence; and, while bearing mournful testimony to the loss of that invaluable assistance which his Royal Highness was so ready at all times to extend to us, we have to offer to the Queen our dutiful thanks for the interest evinced by her Majesty in this undertaking by commanding your Royal Highness and your Lordships to represent Her Majesty on this occasion.

"Our respectful thanks are also due to their Royal Highnesses the Crown Prince of Prussia and Prince Oscar of Sweden, the presidents of the commissions for those countries, for the honour which their Royal Highnesses have done us in coming to England for the purpose of attending this ceremony. In the attendance of his Royal Highness the Crown Prince of Prussia we recognise a cordial deference to the wishes of our Sovereign and a tribute of affection to the memory of his illustrious and beloved father-in-law.

"It now becomes our duty to submit to her Majesty a short statement of the circumstances connected with the realization of the scheme for holding a second great International Exhibition in this country, the necessary powers for conducting which were conferred upon us by the Charter of Incorporation graciously granted to us by her Majesty in the month of February, 1861.

"In the years 1858 and 1859 the Society of Arts, a body through whose exertions the Exhibition of 1851 in great measure originated, had taken preliminary measures for the purpose of ascertaining whether a sufficiently strong feeling existed in favor of a decennial repetition of that great experiment to justify an active prosecution of the scheme. Although the result was stated by the Society of Arts to be satisfactory, the outbreak of hostilities at that moment on the continent necessarily put a stop to further proceedings.

"The restoration of peace in the summer of 1859, however, enabled the consideration of the question

to be resumed, though at a period so late as to render it necessary that the Exhibition should be deferred till the present year; and the Society of Arts obtained a decisive proof of the existence of a general desire for a second great Exhibition in the most satisfactory form, namely, the signatures of upwards of 1,100 individuals for various sums of from £100 to £10,000, and amounting in the whole to no less than £450,000, to a guarantee deed for raising the funds needed for the conduct of the Exhibition.

"The Commissioners for the Exhibition of 1851, mindful of the source from which their property and their continued existence as a corporate body arose, and of one of their earliest decisions, that any profits that might be derived from that Exhibition should be applied to purposes strictly in connection with the ends of the Exhibition, or for the establishment of similar Exhibitions for the future, without hesitation placed at our disposal, free of all charge, a space of nearly 17 acres on their Kensington Gore estate, which was at first considered sufficient for the purposes of the Exhition, but to which at a subsequent period a further area of upwards of eight acres (being all the land which could be made available for those purposes) was added on our application, when the original space proved to be insufficient. For this grant of a site we have to express our thanks.

"To the Governments of Foreign States and of Her Majesty's Colonies our acknowledgements are justly due for the manner in which, with even greater unanimity than in 1851, they have responded to the appeal made to them to assist in this undertaking. In this cordial co-operation we find another proof that the time had arrived when a repetition of the Exhibition of 1851 had become desirable in the common interests of all nations.

"A similar tribute is due from us to those of her Majesty's subjects who appear as exhibitors, or who have placed at our disposal many valuable works to illustrate the various branches of British art, and in this respect our grateful thanks are especially due to her Majesty.

"About 22,000 exhibitors* are here represented, of whom about 8,000 are subjects of her Majesty, and 14,000 of foreign States. The arrangement and design of the building is such that the exhibited articles have been generally arranged in three great divisions:—

"1st. Fine arts, in the galleries especially provided for that department.

"2nd. Raw materials, manufactures, and agricultural machinery, in the main building and the eastern annexe.

"3rd. Machinery requiring steam or water power for its effectual display, in the western annexe.

"Within these divisions the classification adopted is in most respects similar to that employed in 1851, the British and Colonial articles being kept separate from those sent by foreign countries, and each country having its own portion of the several departments allotted to it. The catalogues now presented by us for the purpose of submission to her Most Gracious Majesty will be found to contain all the necessary particulars respecting the articles exhibited.

"In the selection and arrangement of many of the more important branches of the Exhibition we have been materially assisted by the cordial co-operation and advice of persons of all ranks in various local, class, trade, and other committees, whose services we gratefully acknowledge.

"Following the principle adopted in the case of the Exhibition of 1851, we have decided that prizes, in the form of medals, shall be given in all classes of the Exhibition, except those in the fine arts' section; such medals, however, being of one kind only—namely, rewards for merit, without any distinction of degree. Those medals will be awarded by juries appointed for the several classes, and composed of both British and foreign members.

"We are happy to be able to acquaint her Majesty that foreign nations have selected persons of high distinction in science and industry to act as jurors; and we have to bear testimony to the cordial readiness with which eminent manufacturers of this country and other persons distinguished in the State, as well as in the various branches of science and art, have consented to serve as jurors, and accept the responsibilities and labour entailed upon them by so doing. We feel assured that the eminence of the jurors, both foreign and British, thus selected will satisfy exhibitors that the objects displayed by them will be examined by competent as well as by impartial judges. It is certain that the meeting of so many leading men on such a duty, from all parts of the world, must exercise a favourable influence on agriculture, manufactures, and commerce, by disseminating valuable and practical information respecting the condition of science and industry in their several countries, as well as by making known to all that which they need and that which they can supply.

"The articles now exhibited will show that the period which has elapsed since 1851, although twice interrupted by European wars, has been marked by a progress previously unexampled in science, art, and manufacture.

"It is our earnest prayer that the International Exhibition of 1862, now about to be inaugurated, and which it is our privilege to conduct, may form no unworthy link in that chain of International Exhibitions with which must ever be connected the honoured name of Her Majesty's illustrious Consort."

The Duke of Cambridge read the following reply:—

"We cannot perform the duty which the Queen has done us the honour to commit to us as Her Majesty's representatives on this occasion without expressing our heartfelt regret that this inaugural ceremony is deprived of her Majesty's presence by the sad bereavement which has overwhelmed the nation with universal sorrow. We share most sincerely your feelings of deep sympathy with her Majesty in the grievous affliction with which the Almighty has seen fit to visit her Majesty and the whole people of this realm. It is impossible to contemplate the spectacle this day presented to our view without being painfully reminded how great a loss we have all sustained in the illustrious Prince with whose name the first Great International Exhibition was so intimately connected, and whose enlarged views and enlightened judgment were conspicuous in his appreciation of the benefits

* These numbers are only approximate, the returns not yet being all made.

which such undertakings are calculated to confer upon the country. We are commanded by the Queen to assure you of the warm interest which her Majesty cannot fail to take in this Exhibition, and of her Majesty's earnest wishes that its success may amply fulfil the intentions and expectations with which it was projected, and may richly reward the zeal and energy, aided by the cordial co-operation of distinguished men of various countries, by which it has been carried into execution. We heartily join in the prayer that the International Exhibition of 1862, beyond largely conducing to present enjoyment and instruction, will be hereafter recorded as an important link in the chain of International Exhibitions, by which the nations of the world may be drawn together in the noblest rivalry, and from which they may mutually derive the greatest advantages."

The procession then passed along the north side of the nave to the Eastern dome, where the special musical performance took place. The music, specially composed for this occasion, consisted of a grand overture by Meyerbeer; a chorale by Dr. Sterndale Bennett (to words by the Poet Laureate), and a Grand March by Auber. The orchestra, consisting of 2,000 voices and 400 instrumentalists, was presided over by Mr. Costa, except during the performance of Dr. Sterndale Bennett's music, which was conducted by M. Sainton.

At the conclusion of the special music a Prayer was offered up by the Bishop of London. The Hallelujah Chorus and the National Anthem were sung. His Royal Highness the Duke of Cambridge said, "By command of the Queen I declare the Exhibition open."

This declaration having been made, it was announced to the public by a flourish of trumpets, and the firing of a salute on the site of the Exhibition of 1851. The procession then proceeded to the Picture Galleries, and the barriers were removed.

The military bands were those of the Grenadier, the Coldstream, and the Scots Fusilier Guards, conducted by Mr. Godfrey, and were stationed in the centre of the western dome.

About 25,000 persons were present.

THE INTERNATIONAL EXHIBITION.

(Extracts continued from "The Mechanics Magazine.")

The Western Annexe.

"We now beg to direct public attention to a pair of marine engines exhibited by Messrs. John Penn and Son, of Greenwich. These are excellent exponents of the workmanship of Messrs. Penn. They are on the direct acting principle, and are intended for a screw steam-ship. The engines are of the collective power of 600 horses, and have been manufactured for the Spanish Government. The cylinders are 78 inches in diameter, and the length of the stroke is 3 feet 6 inches. The connecting rods are 9 feet long. Several pairs of engines of a nearly similar character have been made for the respective navies, and they have been found to work with perfect smoothness and regularity. Much of this latter is due to the system of counterpoising the crank shaft pursued by Messrs. Penn; and we may say in passing, that it would be well if more attention generally were paid by engineers and machinists to the proper balancing of running machinery. Much of the jarring and tremor, so disagreeably felt on board steamers, and so hostile to the stability of buildings, is due to the want of a proper mode of balancing those parts of the engines or machinery which are of unequal weight.

"Returning to the engines of Messrs. Penn, it may be further said that each condenser is provided with a double acting air pump 23 inches in diameter, the length of stroke being the same as that of the piston. The engines occupy a space 28 feet in breadth by 18 feet in the direction of the length of the vessel.

"Engines of the same kind of construction as these, but of 1,250 H.P., are in course of construction by the firm named. These are intended for H.M.S. Achilles, now being built in Chatham dockyard, and one of the cylinders of the Achilles' engines is exhibited in the annexe. It is a fine and clean casting, well bored out, and its weight is 18 tons. The inner diameter is 42 inches, the stroke will be 4 feet.

"Messrs. Penn also exhibit, in near neighbourhood to the cylinder, a massive wrought-iron crank shaft for the same engines, as also a connecting-rod, fitted complete with brasses. The Warrior and Black Prince were furnished with engines of which those of the Achilles will be duplicates. Before advancing further through the annexe, we may state that Messrs. Penn are at present engaged, also, in making two pairs of engines for the new iron sided ships Northumberland and Minotaur. A cylinder cover belonging to one of these is shown, as are some iron castings from the mould, and others which have passed under machine tools.

"Models of a pumping-engine and safety-balance valve, as erected and used at the Leabridge branch of the East London Water-works, are exhibited by Messrs. Harvey and Co., of Hayle, Cornwall. Having seen the originals of these we can vouch for the fidelity of the models. The Leabridge engine, which was erected by Messrs. Harvey some five or six years since, was at the time of its erection the largest in or near London. When working full-power it pumps 9,000 gallons of water per minute to a height usually of 140 feet. The water thus raised is conveyed into London by means of cast-iron pipes 36 inches in diameter. The whole of the system of pumps, reservoirs, filtering beds, sluices, &c., at Leabridge is well arranged, and everything there is on a gigantic scale.

"In 1858 Messrs. Harvey and Co. erected, for the Southwark and Vauxhall Water Company, at Battersea, a pumping-engine, the cylinder of which is 112 inches diameter, and weighs 36 tons. This engine, though the largest and most powerful ever built for such a purpose, is of the most simple construction. The steam valves are all on the equilibrium principle, and the arrangement of parts is throughout, such, that this colossus of engines, so to speak, is as completely under the control of a

pigmy, but intelligent engine-man, as is the small engine in a factory.

"The quantity of water pumped up for the supply of London daily, amounts to 115,000,000 gallons. Of this enormous quanty 79,000,000 gallons are pumped by means of single-acting engines on Harvey's plan. In fact, the reputation of this firm for gigantic pumping-engines is world-wide. Those who have time to visit Battersea and Leabribge, where the originals of the models referred to exist, would find that they were amply repaid for their trouble by an inspection of them.

"Speaking of water-works we are reminded of the fine specimens of fire-engines exhibited in the Western Annexe. And after the experience of the past year or two in the Metropolis with respect to fires, and the recent report of the Select Committee which has sat on the subject, he must be a bold man who will say that fire-engines are not an important feature in the world's show at Kensington. Every witness examined, including the managers of the Brigade, has admitted—what we long since asserted—that the present state of the staff, engines and stations, is totally inadequate for the protection of London from fire.

"An altered and expanded arrangement in respect to the London Fire Brigade, will unquestionably demand a commensurate improvement and increase in the number of fire-engines. Of steam fire-engines the metropolis has but a scanty supply and we may suggest that attention should be paid to the subject by engineers and others interested in it.

"Messrs. Shand and Mason, Roberts, Merryweather, and others, figure the most largely in this department, but, as we have said, the display is meagre. The American steam fire-engine, forwarded by Mr Hodges, of the Lambeth Distillery, we have before spoken of, but why it should be placed in a corner, where it is difficult for its merits to be disclosed, is a question for the Commissioners, whose ways are difficult to comprehend or account for.

"We come now to a consideration of some of the manufacturing machines and tools. Cotton spinning machinery is largely represented, and Messrs. Dobson and Barlow, of Bolton, contribute a fair quota of the whole. They exhibit, in fact, a series of machines for opening and cleansing, preparing, and spinning cotton. The whole of these are replete with the most modern improvements of detail, and they may be briefly mentioned in the order in which the operations named follow each other in ordinary working. The first is named a cotton-spinner, and is adapted for spinning and cleaning long or short shaped cotton. The feeding parts and the inside gratings, are of a novel construction, the object in view being to open out and clean the cotton without injuring the staple. The second is called the single scutcher, and is supplied with feeding rolls, which have been patented by the firm in question. The merit of the rolls consists in their holding the cotton sufficiently firm without breaking the seeds or shells. Then follows the breaker carding-engine, which is a combined patent machine; Wallman, of the United States of America, and Dobson and Barlow, each having a hand in it. Its chief merits are that the cotton is well opened and cleaned by the working rollers, before the upper rollers will allow it to pass the self-stripping top flats. These flats can be taken out at pleasure by the attendant, and re-adjusted without the use of a screw key. A finisher carding engine stands next, and it works automatically—an improvement on the plan of stripping flats by hand as is usually done. Ashworth's patent lap machine is used for making laps for the finisher carding engine, and combing machine, and a grinding apparatus is so contrived as to grind two rollers and a flat at the same time.

"Then follow five frames, known respectively as the drawing frames, with forty-four spindles, each ten inches by five inches; the intermediate frame with fifty-four spindles, each eight inches by four inches; the roving frame of seventy spindles, each seven inches by three and a half; and the jack frame of eighty-eight spindles, five inches by two and a half.

"The patent self-acting mule, of Dobson and Barlow, makes the total of the cotton-spinning arrangements at the exhibition of that firm. This last presents numerous peculiarities, and the whole of the machines are well fitted up.

"Platt, Brothers, & Co., of Oldham, figure most extensively in the same branch of manufacturing industry, the space devoted to their machines and contrivances being very large. As the Illustrated Catalogue, Part 111, however, does elaborate justice to their cotton working machinery, we need not further refer to it than to say it reflects the highest credit upon the firm, who must have gone to very great expense in forwarding the whole to London, and keeping a large staff of workmen and girls to attend it.

"The cotton machinery of Messrs. Hetherington, of Vulcan Works, Manchester, is not inferior in many parts to that we have already referred to, and, indeed, it will not be the fault of the great firms of the Midland districts, if visitors to the International Exhibition do not gather much valuable information as to the treatment of that vital element of industrial labour—cotton.

"The paper making and paper cutting machines of Messrs. Bryan, Donkin, & Co., of Bermondsey, are suggestive of the immense consequence of the material with which those machines have to deal. This firm have earned a well-established reputation for the excellence of their paper making and dressing machinery, and the gigantic well-finished specimens of their work in the Western Annex prove that they are likely to maintain their fame.

"The Western Annex is, as we stated on a former occasion, extremely rich in specimens of engineering tools, and, perhaps, in this respect Messrs. P. Fairbairn & Co., of Leeds, make as distinguished a show as any. The radial drilling machines exhibited by this firm are excellent specimens of their productions in the tool department, and their universality of application, must make them invaluable in the erecting shops of the engineer and millwright. Of lathes, planing, and slotting machinery, too, they contribute excellent examples.

"In engineering tools of a, generally speaking, less massive kind than those of many of his neighbours, Mr. Whitworth, of Manchester, is largely represented. His lathes, which are so generally used by engineers, not only at home, but abroad, are to be found in every variety at the Exhibition.

There are numerous specimens, also, of drilling and slotting machines, all of which are distinguished by the excellence and exactitude of fitting, which have obtained for Mr. Whitworth a world-wide fame. The wheel cutting machine exhibited calls for especial remark. Those who are aware of the tediousness which attended the operation of chipping and trimming wheels by hand, and the chances which there were, after all, of the teeth being out of pitch, cannot but appreciate the value of this contrivance. It may be made to deal with either metal or wood, and with both spur and bevel gearing. It will cut the teeth or cogs of wheels up to ten feet diameter, and those of pinions down to the smallest size and pitch, and with the certainty of truth and uniformity.

"We spoke but now of the importance of paper; and nearly allied to it in importance is printing. Messrs. Petter and Galpin give us, in the Western Annex, an excellent example of what has been done in the shape of printing machines, and an idea of what may yet be expected; but it remained for the "Type Composing and Distributing Machine Company" to furnish visitors to the Exhibition with an apparatus intended for facilitating the work of the Compositor.

"The machines shown are the invention of the late Mr. James Hadden Young; and, as a plea for their use, we are told that while printing from the composing types has, by the improvements in the steam press, been carried to a most advanced stage, yet that setting up by hand is not done more quickly than it was 400 years ago, by the earliest printers. This certainly developes a *prima facia* case for stimulating the creative powers of mechanical inventors; but we are not quite prepared to say that the machines in the Annex are succesful exemplifications of inventors' powers in this direction.

"A suppositious state of things has been assumed with a view of setting forth more clearly the inestimable value of the type composing and distributing machine, and it is this: Let it be imagined that half an hour before usual time of putting to press, news arrives at the office of a daily journal, which would extend in the telling over three of its columns. This would involve the setting of something like 45,000 types, and in order to accomplish it a staff of ninety compositors would have to be employed. Each of them would have a scrap of paper put into his hand to set up in such a manner that it may tally with his neighbour's piece, technically called "making even." This would, undoubtedly, be a heavy piece of work, and one in the execution of which errors would be likely to creep in. Well, if all be true that is told of the machines named, they would make very light work of it. With them the task would be accomplished by six "players," and twenty-two justifiers in the same time, and only six pieces of copy instead of ninety would be required. The chances of error thus would be lessened.

"The type-composing machine is provided, something after the manner of a pianoforte, with separate keys for all the letters of a fount. This admits of each letter being set up in the order required by the compositor's copy, with a speed which is only limited by the eye and fingers of the player. The art of playing the machine, or as we should prefer terming it, working it, is said to be acquirable by a compositor, with the short noviciate of a few weeks' practice.

"As the type composing machine sets up the type in long lines, Mr. Young invented his "justifying apparatus," which is intended to replace the compositor's stick, an implement it, however, resembles. This is fixed to a frame, and is used as follows:—The compositor places the galley filled with the long lines set up at the composing machine. He fixes one of these lines into the proper apparatus, divides it into its proper length, reads it, makes corrections, and having justified it, he moves a handle, by which the completed line is depressed, and room is made for a succeeding line. It is found that a skilful compositor can justify at the rate of 4000 types per hour.

"As we have said, the whole of the arrangements connected with their adjuncts to the printing office are ingenious, as are the calculations and theories suggested. They do not as yet, however, fulfil all the conditions required in practice, and hand labour in this department of industrial art may be said to hold its own.

"Sewing machines of divers forms, and with little peculiarities, which go to make up a considerable amount of difference, are to be found in the Western Annex. These remarkable domestic appliances have been so minutely described in the MECHANICS' MAGAZINE, in time past, that we need not dwell upon them now. There is no doubt that they are working out a social revolution not only in this country, but throughout the civilised world, and it would have been unpardonable to have omitted altogether noticing the specimens exhibited at Kensington. Messrs. Newton Wilson & Co. are the largest exhibitors, and among the ponderous and massive mechanical appliances by which the sewing machines are surrounded, perhaps there are none which are morally speaking, more powerful.*

The Eastern Annexe.

"Perhaps the Eastern Annexe is, as a whole, one of the most satisfactory departments of the Exhibition—industrially speaking. It is well arranged, and taken alone forms an excellent exemplification of the progres and present condition of agricultural and horticultural science in England. The steam-engine, which had already effected so much for the material comfort and moral welfare of the people of this favoured land, by impelling machinery, and in the varied processes of manufacture, and in transporting people and merchandise from place to place—the mighty and yet delicate steam-engine is shown in the Eastern Annexe to have become also the chief cultivator of the soil. To its irresistible power the stubborn globe is now made to yield its richest treasures, and the golden harvests bow in due season to its "its sturdy stroke." The application of steam to the tilling of the ground is, indeed, one of the proudest achievements of modern time. The eleven years which have elapsed since the existence of the glorious palace of iron and glass in Hyde Park, have developed rapidly the arts of husbandry, but

* An unfortunate error, in respect to the dimensions of the cylinder of the Achilles, as exhibited by Messrs. John Penn & Sons, crept into our last week's notice: the real diameter of that noble casting is 112 inches.

whilst in the Eastern Annexe of the present Exhibition, we are made pleasurably aware of the fact, we find there also sure promise of yet further advancement. Machines and implements, eloquently telling of the skill of those who contrived them, are there to be seen in the greatest profusion, and these are witnesses, too, to the mechanical superiority of Englishmen. Among the prominent objects in the Eastern Annexe is a very handsome specimen of an agricultural locomotive engine. This, as its name implies, is a giant labourer, capable of being employed in any operations on the farm, and who will go on puffing and working without grumbling, so long as any work remains to be done, and his employer provides him with his daily water and coals.

"Mr. Aveling, of Rochester, Kent, is the maker of this farmers' assistant, which has embraced in its composition many novel points and peculiarities. It has an extra large boiler fitted with thirty-seven two and three-quarter inch tubes. The external plates are of the best Butterly iron, whilst the fire-box and tube plates are of Bowling iron. The boiler is judiciously "stayed" in a very strong manner so as to resist high-pressure. The fire-grate measures 31 inches by 34 inches, and may be fed with wood where that material is most accessible. The cylinder, of 10 inches diameter, is surrounded by a jacket, and, being placed on the forward part of the boiler, priming, which sometimes occurs in ascending steep gradients, is thus prevented. The crank-shaft is made of the well-known Low Moor iron, which for such purposes has gained especial and deserved fame. The engine is fitted with improved governor, patent tender, and water tank, under foot plate, driving chain and gear, steam-pressure guage, secret, as well as open safety-valve and other minor appliances. The driving wheels are 5 feet 6 inches in diameter, and 12 inches wide. Altogether it is a well arranged and compact machine, remarkable for its simplicity and strength. It is said to be capable of drawing ten tons up a gradient equal to 1 in 6, and is easily managed by an ordinary engine-driver.

"Messrs. Barrett, Exall, and Andrews, of the Kates-grove Iron Works, Reading, present, further on, some admirable specimens of workmanship in the shape of steam, and horse-thrashing machines, engines, mills and agricultural machinery generally. Of reaping, mowing, and thrashing machines, haymakers, &c., Burgess and Key, of Newgate-street, present some excellent specimens. They are placed on the west side of the Eastern Annexe. This firm have, we believe received more prize medals for agricultural implements than any other firm in England, and this fact speaks trumpet-tongued of the excellence to which they have attained.

In the matter of steam ploughs and a great variety of other implements for the cultivation of land and the gathering in of its fruits. Messrs. M. Garrett and Son, of Leiston Works, Suffolk, and James and Frederick Howard, of Britannia Iron Works, Bedford, are large exhibitors. The first-named firm have erected a stand for the display of their wares, and which discloses a considerable amount of artistic skill on the part of its constructor.

"Messrs. Ransomes and Sims, of the Orwell Works Ipswich, are very largely represented on the West side of the Eastern Annexe, both as regards steam engines and apparatus for agricultural purposes, and implements to be worked by horse or manual labour. Indeed, it would be almost an impossibility to barely enumerate the specimens which they have sent to the Exhibition. Perhaps their 15 H.P. horizontal stationary high pressure steam engine is the best exponent of their ability as engineers. The boiler of this is on the Cornish principle, the fire being placed in an internal flue. The flame first passes through, and then along each side of the boiler to the chimney. This arrangement is calculated to generate steam rapidly, whilst any sediment contained in the water used will collect *under* the fire flue—a great practical advantage—because the deposit in that case will not interfere with the generation of steam. There is an air of substantiality about engines of this construction which speaks well for their continuing long in good condition. Mounted on a stone base, to which the bed-plates are firmly bolted, an engine of this kind would be admirably adapted for working machinery of almost any kind, but for thrashing machines, saw, or corn mills, it would be especially useful. The improvements made in horse ploughs—the judicious combination of lightness with strength—are seen in the specimens of Messrs. Ransomes and Sims.

"Of traction engines and highway locomotives there are several varieties. Those of Robey and Co., of Lincoln, are not the least excellent of them.

"Of thrashing machines there are many varieties; but one exhibited by Tasker and Sons, of the Waterloo Iron Works, Andover, Hants, calls, perhaps, for especial notice at our hands. It is patented, and known as the Combined Thrashing Machine. It performs, indeed, a number of distinct operations, as separating the corn, straw, caving and chaff, from each other, and depositing them in the place assigned to each. It is, indeed, a favourable example of the ingenuity of the firm who have deposited in the Annexe.

"A double corn mill, fitted with two pairs of stones, is shown by Mr. John Tye, of Lincoln. Its portability is one of its highest recommendations. It may be transparted from place to place easily, and is workable by steam, wind, or water-power. Infinite however, are the treasures of the Eastern Annexe, and many of them must be left unexplored and unexplained until a further opportunity for doing both presents itself."

ECONOMIC MINERALS OF CANADA.

An elaborate descriptive catalogue of economic minerals of Canada, sent to the Exhibition, has been prepared by Sir Wm. Logan, F. R. S. Each substance is arranged under a heading connected with some of its more prominent applications. The locality from which the mineral comes, and the name of the exhibitor, are in every case given. The headings under which minerals are classed, are—metals and their ores; minerals applicable to chemical manufacture; refractory minerals; minerals applicable to common and durative construction; grinding and polishing minerals; mineral manures; mineral paints; minerals applicable to the fine arts; minerals applicable to jewellery;

and miscellaneous minerals. To Sir W. Logan's catalogue there is appended an equally carefully arranged catalogue of the crystalline rocks of Canada, by Mr. T. S. Hunt, F. R. S. The collection is sent by the Geological Survey of Canada; and the specimens are arranged according as the rocks are Laurentian, Huronian, Lower Silurian, or Eruptive. The collection is, doubtless, very complete; and tends materially to confirm the opinion which has long been entertained by those acquainted with the Province, that Canada is destined to become, at no distant period, a great and prosperous mining country.—*Mining Journal.*

PHOTOGRAPHY.

Side Light v. Vertical Light.

A writer in Dickens' *All the Year Round,* says:—"It is perfectly surprising that this has not been more considered by all photographers. Their process is a thing simply of light and shade. It is the light that makes the portrait come into existence at all. The patches of shade, more or less dark, alone prevent a *carte de visite* from being a sheet of blank paper. Surely the shapes of those patches of shade are all-important. It is little known—and when it *is* known we have prettier photographs—that a light coming from above the head of the sitter is the most unbecoming thing in the world, and that a face so lighted cannot by any possibility show to advantage. Now, the ordinary photographer's glass room has a diffused light all over it, but mainly coming from above, so that the eyes show in two dark caverns of shadow, while a black patch appears under the nose, throwing the termination of that feature up to the skies, and making it show as an isolated nob, the full size of which is—and few of us can bear this—done the amplest justice to. This top-light, moreover, scores out relentlessly those baggy marks which many of us have too well developed under the eyes, and which are not characteristics of the human beau-ideal, while—in the case of ladies—a kind of trough on each side of the mouth is joined to the chin-shadow after the fashion of a Vandyke beard.

"In ladies portraits, the elimination of beauty, and not so much of character as in men, is the thing to be borne in mind. Now, the most becoming light is one level with the face, or even, perhaps, somewhat beneath it—it being a great mistake to suppose that the foot-lights on the stage are unbecoming. Such a light as that described above would make any face in the world ugly, and yet it is just such a light which is to be found in most photographers' rooms.

"As much as possible, as may consist with the action of the photographic process, the light from above should be got rid of in taking these portraits, and a light from the side brought into use."

Photography at the International Exhibition.

"About the time these lines will be before our readers' eyes, the first steps will have been taken towards the commencement of the ceremonial for inaugurating the International Exhibition; and as the majority of our readers will clearly not be present, they will no doubt be gratified to learn that, through the aid of their favorite pursuit, they will stand a fair chance of being hereafter eye-witnesses of the scene, by what we may designate a scientific second-sight.

"Many have doubtless already learned, from the pages of the daily newspaper press, that the exclusive right of taking photographs of and in the building during the continuance of the Exhibition has been purchased by the London Stereoscopic Company. It would not be discreet to name the exact amount paid for the privileges conceded, but we may mention that the sum of fifteen hundred guineas was paid down on signing the contract: the total amount the Commissioners will ultimately receive under the arrangement entered into will certainly be upwards of three thousand pounds. For this handsome sum several of the absurd restrictions proposed to be insisted on, and to which we drew attention in a former article, have been rescinded, and every reasonable concession has been made by the Royal Commissioners, to the intent that the work may be thoroughly and usefully performed.

"Most extensive preparations have been made for photographing the opening ceremonial and the chief posts for the execution of this important duty will be occupied by very able and responsible officers of the Stereoscopic Company.

"An erection fifteen feet high is, while we are writing, in course of construction immediately in front of the Portuguese department, for the purpose of commanding a view of the throne when all the exalted personages who will take the initiative part in the impressive ceremony of the inauguration will be grouped together, and the task of obtaining a permanent record of the event will be entrusted to Mr. W. England, whose admirable instantaneous views, which we have recently described, are sufficient guarantee for his peculiar fitness for this very responsible post of honour. Of course he will be attended by an appropriate staff of assistants.

"On either side of the western dome, where the address is to be read, will be stationed Mr. W, Russell Sedgefield and another photographic artist. The selection of Mr. Sedgefield to take a prominent part in the task of securing a photographic representation of this imposing spectacle is a happy and appropriate one.

"Another 'base of operations,' somewhat further removed in the nave, will be situated so as to embrace the orchestra, and give a *coup d'œil* of the whole. This very important post will also be occupied by a highly accomplished and artistic photographer, Mr. Stephen Thompson, with whose photographic works some of our readers are familiar; and we may presume that all are so with his literary productions, seeing that his contributions appear in our columns. Mr. Thompson will likewise be accompanied by his subordinates. From two other 'posts of observation,' one to the extreme right and the other to the extreme left of the orchestra, a sort of cross fire will be maintained in the reverse direction to those already indicated, bearing upon the spectators of the scene, amongst whom we may safely calculate upon a majority of ladies being included. It will be the task of the operators occupying these positions—we ought rather to have said the privilege—to secure a record of such a collection of beauties as perhaps

never before for abundance can have been equalled: there is probably no other country in the world than our own where ladies form so large a proportion of the attendants at any public ceremony, and certainly none in which the sweet English faces can be surpassed. Acting as a foil and in curious contrast to these will be the Japanese Ambassadors, with their tawny complexions and splendid costumes.

"The first proofs from the various plates secured are to be immediately forwarded by express to Her Majesty at Balmoral. Orders have already been received by the contractors from one firm alone for fifty thousand prints; and we understand that any attempt at piracy will be stringently prosecuted.

"The time of year is much in favour of photographic success, the actinism being perhaps at its maximum during the month of May. We sincerely trust that the weather will be propitious for the occasion.

"The Jurors selected by the Royal Commissioners to adjudicate upon the merits of the photographs exhibited are Lord Henry Lennox, Professor Tyndall, Dr. Diamond, M. Claudet, and Mr. Thurston Thompson."—*British Journal.*

THE ECONOMIC MINERALS OF CANADA.

A very valuable and interesting descriptive catalogue of a collection of the Economic Minerals of Canada and of its Chrystalline Rocks, sent to the London International Exhibition, has just been issued by Sir W. E. Logan and Mr. Sterry Hunt. This catalogue not only describes the different minerals, and the extent to which they are worked in Canada, but it also points out the exact spot where they are to be found, and the probable extent of the deposit. We propose to insert in the Journal from time to time copious extracts from this valuable catalogue, and we commence with the "Minerals applicable to common and decorative construction."

Building Stones.

Chevrotiere.—The Trenton formation, which is the next in succession above the Birdseye and Black River, yields excellent building stone at Montreal, at Chevrotiere, nearly forty miles above Quebec, and at many intermediate places. The best stone at Montreal is derived from a ten feet band of grey bituminous granular limestone, in beds of from three to eighteen inches thick at the bottom, passing at the top, into a black nodular bituminous limestone; which is interstratified with black bituminous shale, in irregular layers of from one to three inches. This grey limestone, which is near the base of the formation, is a mass of comminuted organic remains, which consist largely of the ruins of crinoids and cystideans. The crystallization of these fossils gives a crystalline character to the rock. A considerable number of quarries are worked upon this band of grey limestone, there being four principal ones near Montreal, and the best houses of the city are built of the stone. The quantity of stone annually quarried in the immediate vicinity of Montreal is computed to be:—

313,200 cubic feet of cut stone...28,600 tons.
5,252 toises of rubble............63,024 "

91,624 "

The prices of good stone in Montreal are:—

Ashler stone, undressed......... .....$0.13⅓ ⅌ sq. ft.
Ashler stone, dressed.................. 0.30 "
Mouldings, from $0.16⅔ to $3, or for
a fair moulding ....$1.50 ⅌ lin'ar ft
Fluted columns 18 inches diameter
for the stone.......................$1.00 " rising ft
" " " for cutting...$2.50 "
Heavy rough stone, from 6 to 30
cubic feet, from..........$0.30 to 0.50 " cubic ft.
Very heavy rough stone,
say 60 cubic feet ....$1.00 " "

The strata in the neighborhood of the city are much traversed by trap dykes, which probably have a connection with an intrusive mass extending over 700 acres, and constituting Mount Royal, from which the city and island take their name. Some of the quarries display a number of these trap dykes which run in several directions and intersect one another. In some instances, the limestone, having been removed from among them, the dykes are left standing up several feet above the bottom of the quarries, representing in a marked manner the various details of the cracks they once filled.

In the seigniory of La Chevrotiere, a very excellent limestone for building is obtained between three and four miles back from the St. Lawrence. It usually goes, however, under the name of the Deschambault stone, in consequence of its being put on board of boats at this place. The stone is of a yellower or warmer grey than the Montreal stone; it is more even in its tint, and becomes somewhat less discolored by weathering. It is more granulor and more easily cut, being softer and tougher, but it does not take so fine nor so sharp an edge, nor does it *pick* so well. Three beds of pretty uniform character are worked; the top and bottom ones are eighteen inches thick each, and the middle one three feet. There is said to be a fourth bed beneath, with a thickness of four feet, which has not been quarried. The strata are so nearly horizontal, that it is difficult to determine their dip; it is therefore probable that the stone will spread to a considerable extent in the vicinity. Along the concession line, it is known for twenty-six acres to the S. W., and five acres to the N. E., and on the road across the concession, it is visible for a breadth of ten acres; beyond which, in sinking wells to a depth of twenty feet in blue clay, no rock is met with. The produce of the quarries of La Chevrotiere has a deserved celebrity in Quebec, where it has been used in the construction of churches and other buildings.—*Trenton formation, Lower Silurian.*

Dolomites or Magnesian Limestone.

Owen Sound.—This beautiful and enduring stone can be obtained in unlimited quantities, the formation from which it is derived being here 150 feet in thickness, and divided into beds varying from a few inches to six feet. This stone possesses the very great advantage of being free from any substance producing stains. Its color rather improves with the weather, and the beauty of no building erected of it appears, as yet, to be marred by the

growth of lichens. It is especially adapted for heavy masonry, and blocks of any required size can be obtained. The quarries are about half a mile from the harbor.—*Niagara formation, Middle Silurian.*

Noisy River Falls, Nottawasaga, Lot 3, Range 11.—This stone is from the lower part of the Niagara formation, and is rather more compact than the Owen Sound specimen. The cliff is here about fifty feet high, and might be quarried with the greatest facility. Few of the beds are less than two feet in thickness, and some of them are about five feet, but the locality is not near to any navigable water or railway.—*Niagara formation, Middle Silurian.*

Rockwood, Eramosa, Lot 5, Range 4.—This specimen is also from the Niagara formation, which is here more than 100 feet thick. The greater part of it consists of thick-bedded light grey porous crystalline dolomite. The beds vary from a few inches to ten feet in thickness; about thirty feet of it is almost white. Buildings of cut stone obtained from this band, are observed to improve in color after exposure, and at a short distance, have a silvery white appearance. The piers of the long railway viaduct over the valley of the Eramosa, at Rockwook, are built of stone from this formation, and have a very substantial appearance. The axis of an east and west anticlinal, runs under Rockwood, carrying a spur of the Niagara formation several miles to the eastward of the general trend of the outcrop. A north and south anticlinal passes under the same place; being one of a series which produces southward indentations in the outcrops of the palæozoic strata all the way from Kingston to the main body of Lake Huron.—*Niagara formation, Middle Silurian.*

Guelph, Lot 20, Range D.—This stone is from the immediate vicinity of the thriving town of Guelph. The quarries expose fifteen feet of strata similar to the specimen. The thickest bed is four feet, and the thinnest about three inches. The stone is a light grey crystalline dolomite, like the last, somewhat cellular, but strongly coherent. It is easily worked, is suitable for the best architectural purposes, and appears to be of a durable character. The Guelph formation extends over a large area, and much of it is of the same character as the specimen.—*Guelph formation, Middle Silurian.*

Oxbow, Saugeen River, Brant, Lot 2, Range 8.—The beds are near the summit of the Onondaga formation, and yield probably the best dolomite for fine architectural purposes which has yet been discovered in the country. It resembles the Caen stone in the facility with which it can be worked, but it is closer grained, and by no means so absorbent, and is thus better adapted for withstanding the Canadian climate. Two bands, of about ten feet each, occur here, in the upper part of the Onondaga formation. The higher one is exposed at the surface, in a position offering every facility for quarrying it. The bed from which the specimen was procured, is two feet thick, free from stains, and splits with great precision with the plug and feather. The whole upper band is composed of thick beds of the same character; the thickest one in the lower band measures over three feet. The lacality is near a projected line of railway, and is twenty-two miles from Southampton Harbor by the present road. It overlooks the Saugeen River, down which large scows can be floated to Southampton.

The specimen is from a very light grey oolitic bed, seventeen inches thick, immediately beneath the previous bed. It has been used for supporting water wheels, in mills in the neighborhood, and found to answer well, becoming highly polished under the action of a revolving shaft.—*Onondaga formation, Upper Silurian.*

Sandstones.

Lyn, Elizabethtown, Lot 26, Range 2.

Nepean, Lots 27, 28, 29, Ranges 5, 6.

Augmentation of Grenville.

Quin's Point, Seigniory of La Petite Nation.

These stones are derived from the Potsdam sandstone, which constitutes the summit of the lowest group of fossiliferous rocks of Canada. A quarry has been opened on the outcrop of the rock, at Lyn, by Mr. B. C. Brown, and the stone from this, and from a quarry on the property of Mr. Keefer, at Nepean, in the same formation, has been used in the construction of the new Parliament buildings at Ottawa. At Lyn, the beds of sandstone are massive, and are seen resting on the Laurentian gneiss.—*Potsdam group, Lower Silurian.*

Pembroke.—This fine freestone is much exposed in the vicinity of the Allumette rapids, near Pembroke. A quarry has been opened on it, on the land of Mr. Peter White, where it occurs in beds varying in thickness from six to eighteen inches. It is easily wrought and carved, and although soft, is tough, and retains sharp angles and corners.—*Chazy formation, Lower Silurian.*

Hamilton, Barton.—This fine grained compact greenish-grey sandstone is from a deposit of about ten feet in thickness. Some of the beds are thick, but others are thin enough for flagstones; the stone is free from iron stains, but subject to a growth of lichens in shaded and moist situations.—*Grey band, Medina formation, Middle Silurian.*

Georgetown, Esquesing, Lot 22, Range 7.—This is from a bed of light grey freestone, which belongs to a band of about twenty feet in thickness. The beds are mostly thick, fine grained and compact; some split into good flagstones; but all are rather hard for grindstones. It has been used in constructing culverts on the Grand Trunk Railway, and numerous buildings in Toronto, among which are the University and other important structures, and it appears to answer well.—*Grey band, Medina formation, Middle Silurian.*

Nottawasaga, Lot 2, Range 6.—These stones are from a band of fine grained soft light grey freestone, supposed to be twenty feet thick. The beds are from two inches to three feet in thickness; some of them *reedy*, or marked by lines of stratification. The stone yields good grindstones, but has not yet been much used for building purposes, although from the specimen A, it would appear to be well suited for such. From the facility with which parallel-faced blocks of the required thickness can be obtained, this stone is well adapted for stove-pipe holes, for which it is much used.—*Grey band, Medina formation, Middle Silurian.*

North Cayuga, Lot 48, Range 1.—A band of white sandstone runs through Haldimand County

in Western Canada, and is largely developed on the Oneida and North Cayuga town-line, north of the Talbot road. Its beds are massive, ranging in thickness from one to three feet, and when fine grained, it is well adapted for building purposes. A quarry has been opened in it, on the land of Mr. William DeCew, from whom this specimen of building stone was obtained.—*Oriskany formation, Devonian.*

Labradorite.

Abercrombie.—The opalescent variety of labradorite occurs in cleavable masses in a fine grained base of the same mineral character, which forms mountain masses. Where these are thickly disseminated in the paste, the stone becomes a beautiful decorative material, applicable to architectural embellishment, and to articles of furniture. Its hardness is about that of ordinary feldspar, and it would, in consequence, be more expensive to cut and polish than serpentine or marble, but it is not so readily scratched or broken, and would therefore be much more lasting. Professor Emmons states that a block of the stone submitted to the action of a common saw, such as is used in sawing marble, moved by the waste power of a common water-mill, was cut to the depth of two inches in a day. This is understood to be one-fifth the amount that would be cut in a block of good marble in the same time, by the same means. It would thus appear that though the operation is slower in the case of labradorite, there is no greater amount of mechanical contrivance required than for marble, and that slabs could be prepared for chimney pieces, for pier tables, and other articles of furniture, at a cost beyond that of marble, not greater than is proportionate to the superior beauty and durability of the material.—*Laurentian*

Gneiss.

St. Charles Reservoir, Jeune Lorette.—This stone has been used for building the dam and reservoir of the Quebec water-works, on the St. Charles river. The gneiss, which is obtained a short distance above the reservoir, is hornblendic, being composed of translucent, colorless quartz, white orthoclase, (the feldspar predominating over the quartz,) and black hornblende, all running in irregular parallel planes, showing the gneissoid structure very distinctly, and having at a little distance, a general grey color. The rock may be split in almost any direction by means of wedges, but most easily in that of the gneissoid layers, particularly when these are even. The layers are occasionally affected by undulations and contortions, but these do not materially affect its dividing by means of wedges. The rock splits and dresses with most difficulty at right angles to the gneissoid layers, but is capable of receiving fine smooth faces, with sharp edges and corners. Masses of almost any size can be blasted out from the rock, and large blocks have been dressed and applied to the masonary work of the reservoir, which will no doubt prove a structure of the most lasting character.—*Laurentian.*

Grenville.—The porphyroid orthoclase gneiss, which this specimen represents, forms great mountain ranges among the Laurentian rocks, rising into the highest peaks of the orthoclase region, and generally constituting the main body of rock, which separates the great limestone bands from one another. These masses of gneiss appear sometimes to attain several thousand feet in thickness, but are divided at unequal intervals, by thinner and less feldspathic bands, in which the stratification is more distinct.—*Laurentian.*

Syenite.

Grenville.

Barrow Island, River St. Lawrence, opposite Gananoque.—The intrusive masses of the Laurentian series consists chiefly of syenite and dolerite. These rocks occur in many parts of the country, but their relative ages have been ascertained principally by the investigation in the counties of Ottawa and Argenteuil. What appear to be the oldest intrusive rocks are dykes of a rather fine grained dark greenish-grey greenstone or dolerite, varying in thickness from a few feet to a hundred yards. Their general bearing appears to be E. and W. These greenstone dykes are interrupted by an intrusive syenite, a mass of which occupies an area of about thirty-six square miles in the townships of Grenville, Chatham, and Wentworth. The specimens 1, 2, are derived from it, and 3 is from an area of a similar character, occurring between Kingston and Gananoque. In Grenville, the syenite is penetrated by dykes of what has been called felsite-porphyry, hornstone-porphyry, or orthophyre, having for its base an intimate mixture of orthoclase and quartz, colored by oxyd of iron, and varying in color from green to various shades of black. Throughout the paste, which is homogeneous and conchoidal in its fracture, are disseminated well defined crystals of a rose-red or flesh-red feldspar, apparently orthoclase, and, although less frequently, small grains of nearly colorless quartz. All of these intrusive masses are cut by another set of dolerite dykes, which probably belong to the Silurian, or perhaps to the Devonian period.—*Laurentian.*

Granite.

St. Joseph Beauce.—This band of granite, which has a considerable proportion of quartz, has been used in the seigniory of St. Joseph for millstones, and would yield a strong and durable building stone, is about fifty or sixty feet thick. It runs with the stratification, near to a band of serpentine, and is supposed to be an altered sandstone, and not an intrusive rock.—*Quebec Group, Lower Silurian.*

Barnston.—An intrusive granite of Devonian age occurs in considerable abundance in the Eastern Townships, and forms many isolated hills, the whole of them of small size, with the exception of Great Megantic Mountain, which occupies an area of about twelve square miles. The rock splits well with plug and feather, and can be obtained in blocks of almost any required size. It forms a handsome building stone, and has been used for bridges on the St. Lawrence and Atlantic Railway. It is composed of white quartz and white orthoclase feldspar, with black mica. An area of this rock occurs in Stanstead, covering six square miles, and there is another in Barnston, from which the specimen now exhibited was obtained. Granite of the same character, and probably of the same age, is widely distributed in the State of Maine, and is traceable to New Brunswick, where it is overlaid by the Carboniferous rocks.—*Devonian.*

Board of Arts and Manufactures for Upper Canada.

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE DURING THE MONTH.

CLASS VI.

The Art of Illuminating as practised in Europe from the Earliest Times. Illustrated by Borders, Initial Letters and Alphabets. Selected and Chromolithographed by *W. R. Tymms*, with an Essay and instructions by *M. Digby Wyatt.* 4to. 1860.

CLASS IX.

The Steam Engine, in its various applications to Mines, Mills, Steam Navigation, Railways, and Agriculture. 4to. 1861 .... *John Bourne.*

CLASS XX.

Art Journal, with International Exhibition Catalogue of Art Manufactures, monthly .... *London.*
American Gas Light Journal, semi-monthly.......... *New York.*
Engineer, weekly .... *London.*
Mining Journal, weekly .... "
Practical Mechanics' Journal, monthly.......... "
The Technologist, monthly .... "

BRITISH PUBLICATIONS FOR APRIL.

	£	s.	d.	
Adams (H. G.) Cyclopedia of Female Biography, fcap. 8vo. red. to..........	£0	5	0	*Groombridge.*
———— Poetical Quotations, fcap. 8vo. red to	0	5	0	*Groombridge.*
———— Sacred Poetical Quotations, fcap. 8vo. red. to	0	5	0	*Groombridge.*
Albert's (Prince) Golden Precepts; or the Opinions and Maxims of his late R.H., 16mo.	0	2	6	*Low.*
Archer (Thos. Croxen) Vegetable Products of the World in Common Use, ill. roy. 16mo	0	2	6	*Routledge.*
Arnott (Neil) Survey of Human Progress towards Higher Civilization, 2 e. with ad. 8vo	0	6	6	*Longman.*
Artist and Craftsman, cheap ed. cr. 8vo	0	6	0	*Macmillan.*
Auckland (William, Lord) Journal and Correspondence, vols. 3 and 4, 8vo..........	1	10	0	*Bentley.*
Bacon (Lord) Letters and Life, including his Occasional Works, by J. Spedding, 2 v. 8vo	1	4	0	*Longman.*
Bacon's Essays and Locke's Conduct of the Understanding, 18mo..........	0	1	4	*Chambers.*
Beardmore (N.) Manual of Hydrology, containing Hydraulics and other Tables, &c. 8vo	2	2	0	*Waterlow.*
Beeton's Book of Birds, showing how to Rear and Manage them, cr. 8vo..........	0	3	6	*Beeton.*
Beveridge (Henry) Comprehensive History of India, ill., vol. 3, roy. 8vo..........	1	1	0	*Blackie.*
Blair (Mrs. Fergusson) Henwife, her own Experience, illust. new ed., fp. 8vo. plain 4s. 6d., coloured..	0	7	6	*Hamilton.*
Book of Dates (The); or, Treasury of Universal Reference, new ed., cr. 8vo..........	0	7	6	*Griffin.*
Bradshaw's Railways, &c., Through Route and Overland Guide to India, Turkey, Persia, &c., new ed. sq..........	0	5	0	*Adams.*
British Empire (The), Historical, Biographical, and Geographical, 3rd ed., cr. 8vo...	0	7	6	*Griffin.*
Brooke (R.) General Gazeteer in Miniature, rev. by A. G. Finlay, new ed., fp. 8vo...	0	5	0	*Tegg.*
Bryce (Jas.) Universal Gazetteer, 3rd ed., thoroughly revised, 8vo..........	0	8	6	*Griffin.*
Canton (R.) Art of Illuminating Made Easy, obl..........	0	1	6	*Canton.*
Clever Boys of Our Time, and How they became Famous Men, fcap. 8vo. red to......	0	5	0	*Darton.*
Dod (R. P.) Peerage, Baronetage and Knightage of Great Britain & Ireland for 1862, sm. cr. 8vo	0	10	6	*Whittaker.*
Illustrated Catalogue of Stained Glass Windows, 4to..........	0	2	6	*Heaton & Co.*
Johnson (Geo. W.) Science and Practice of Gardening, illus., fcap. 8vo.......... ...	0	3	0	*J. of Hort. O.*
Jukes (J. Beate) Student's Manual of Geology, new ed., partially recast, illus., cr. 8vo.	0	12	6	*Black.*
Lawson (Wm.) Geography of the British Empire, fcap. 8vo..........	0	3	0	*Hamilton.*
Lewin (Thos.) Invasion of Britain by Julius Cæsar, 2nd ed., 8vo..........	0	10	0	*Longman.*
London Labour and the London Poor, extra vol. Those that Will not Work, 2 ed. 8vo	0	10	6	*Griffin.*
Marshall (Frederick) Population and Trade in France in 1861–62, post 8vo	0	8	0	*Chapman & H.*
Mayhew (Henry) and Binny (John) Criminal Prisons of London and Scenes of Prison Life, 8vo	0	10	6	*Griffin.*
Mill (John Stuart) System of Logic, Ratiocination and Inductive, 2 vols. 5th ed. 8vo	1	5	0	*Parker & Son.*
Miller (Hugh) Essays, Historical and Biographical, Political and Social, cr. 8vo	0	7	6	*Hamilton.*
Miller (Thomas) Catechism of the Marine Steam Engine, fcap. 8vo. red. to..........	0	2	0	*Spon.*
Mursell (Rev. Art.) Lectures to Working Men, 5th ser., v. 2, cr. 8vo., sd. 10d..........	0	1	4	*Simpkin.*
———— 5th ser., comp. in 1 vol., cr. 8vo......	0	2	3	*Simpkin.*
Oliphant (L.) Nar. of Earl of Elgin's Mission to China and Japan, 2 v. 8vo. red. to...	1	1	0	*Blackwoods.*
Ranken (Major) Canada and the Crimea, Sketches of a Soldier's Life, post 8vo........	0	7	6	*Longman.*
Read (W. T.) Pop. and Math. Astronomy, with Formulæ of Plane Trigonometry, &c., cr. 8vo..........	0	5	0	*Longman.*
Rhind (A. H.) Thebes, its Tombs and their Tenants, ancient and present, sup.-r. 8vo	0	18	0	*Longman.*
Swainson (William) New Zealand and the War, post 8vo..........	0	5	0	*Smith & Elder.*
Tarbuck (Ed. L.) New Illustrated London Guide for 1862, with Map, post 8vo..	0	1	6	*Hagger.*
Thom's British Directory and Official Handbook of the United Kingdom, 1862, r. 8vo	0	12	6	*Groombridge.*
Webb (E. B.) on Iron Breakwaters and Piers, 4to..........	0	2	0	*Lockwood.*

AMERICAN PUBLICATIONS FOR MAY.

Annual of Scientific Discovery; or Year Book of Facts in Science and Art, for 1862, 12mo	$1 25	*Gould & Linc'n*
Browning (Eliz. Barrett) last Poems, with a Memorial	0 75	*James Miller.*
Harris (T. W., M.D.) A Treatise on Insects injurious to Vegetation, 8vo	6 00	*Crosby & Nich.*
Irving (Washington) Life and Letters of, vol. 1, 12mo	1 50	*G. L. Putnam.*
Life of Arthur Vandeleur, Major Royal Artillery, by the author of "Memorials of Captain Hedley Vicars," &c., 12mo	0 75	*R. Carter & B.*
Lighthill (E. B., M.D.) Popular Treatise on Deafness, with illustrations, 12mo	0 50	*Carleton.*
Mill (John Stuart) Considerations on Representative Government, 12mo	......	*Harper & Bros.*
Taylor (Bayard) Adventures in the Path of Empire, 12mo	1 50	*G. P. Putnam.*
Taylor (Isaac) The Spirit of Hebrew Poetry, with Sketch of the Life of the Author, and Catalogue of his Writings, 12mo	1 00	*Wm. Gowans.*
Wedgewood — A Dictionary of English Etymology, vol. 1, 8vo	3 00	*Sheldon & Co.*
Woolsey (T. D.) The Study of International Law, 12mo	1 50	*J. Monroe & Co.*

Patent Laws and Inventions.

RECENT CANADIAN INVENTIONS.

Fisher's Hollow Bricks.—The Specifications furnished are too lengthy for insertion in our columns, but, with the drawings and models of the bricks, may be seen in the rooms of the Board.

What the inventor claims is, that of hollow bricks of such sizes and form as practically adapt them to economy in the manufacture, and to the building of walls on a new and improved method.

The advantages and superiority claimed for this invention may be thus summarily stated.

1. Economy of Space.
2. Economy of Cost.
3. Improved Sanitary Conditions.
4. Security from vermin and diminished liability to loss by fire.

First—Economy of Space. A wall may be built of eight inches in thickness, more or less, containing continuous air spaces, subserving the purposes of ventilation and preventing the transmission of moisture, heat, and sound, equally well with, if not better, than a solid one of greater thickness; thus admitting of larger apartments on a given space of ground.

Second—Economy of Cost. As compared with ordinary bricks, their manufacture requires a less quantity of raw material, a smaller expenditure in its preparation, less time in drying, less fuel in burning, and less weight in transportation, so that larger loads may be moved for a given sum. In building, these bricks occupy twice the space taken up by ordinary ones in the wall, and their bearing on those beneath being much less than that of ordinary bricks, less than half the usual quantity of mortar will suffice for laying them—no mean saving in localities where lime or sand are scarce and dear; less expense in interior finishing, obviating the necessity for furring and lathing, and economy generally, inasmuch as by the use of these hollow bricks, building works may be carried on at all seasons of the year.

Third—Improved Sanitary Condition. By the use of these bricks, buildings may be constructed with economy of cost and space, and at the same time secure superior Sanitary Advantages in the way of ventilation, with freedom from cold and moisture; not heretofore attainable without increased expense.

Invented by Arthur Fisher, Montreal.

Moodie's Rotary Interest Indicator.—This Invention consists of a hollow case of tin, brass or copper, or other suitable metal, with an opening along the length of the face, on the side or edge of which opening, a graduated column with figures is placed. Within the case are placed two rollers of wood or metal, which rollers are worked by means of a toothed wheel geared into two pinions, which pinions are attached to the end of the rollers. To the rollers is attached a strip of paper, linen, or other suitable material, on which is written or printed the figures requisite for ascertaining by inspection the exact amount of Interest from one day to any number of years, and at the several rates of Interest in use in this Province—or with tables shewing the quantities of timber, earthworks, time tables, and for the general purposes of a Ready Reckoner.

What the inventor claims is the application of a hollow case furnished with rollers, which rollers are worked by means of a toothed wheel and pinions, and on which is placed paper, cloth, or other suitable material marked with the necessary figures for indicating the amounts of Interest at various rates, and for other purposes above enumerated. Invented by J. W. Dunbar Moodie, Belleville.

ABRIDGED SPECIFICATIONS OF ENGLISH PATENTS.

2474. J. Stewart. *Improvements in the treatment of oils retained by distillation of bones and other animal matters for the purpose of obtaining matters which may be used as pigments and dye stuffs.* Dated Oct. 4, 1861.

This process is to treat common bone oil with hydrochloric acid, or a solution of sulphuric acid;

then to separate the dirty acid, and treat it with alkalis, when a substance is deposited which forms a brown pigment. The oil is then placed in a retort, with certain proportions of oxide of iron, and carbonate of potash, and the whole is distilled over until perfectly dry, the product being refined bone oil, and the residuum left ferrocyanide of potash, and may be used as such or converted into Prussian blue.

2490. W. Rowan. *Improvements in cylinders or drums and beaters for machines for scutching and preparing flax and other fibres.* Dated Oct. 5, 1861.

Hitherto the cylinders or drums employed in the scutching and preparing of flax and other fibres have been rigid, and consequently, the combs, beaters, pins, or teeth fixed thereto or thereon, have been rigid also, and have therefore, acted more or less injuriously on the fibres, Now by this present invention this defect is remedied, and the invention consists in forming the cylinders or drums in segments, and in making one end of each segment fast to the frames, while play is allowed to the other end limited by stop pins or otherwise; the free ends of the segments or those to which play is allowed, carry the combs and beaters or other tools or apparatuses intended to act on the fibres. The rapid rotary motion imparted to the drum causes the combs, beaters, or other apparatuses to be thrown by centrifugal force with a spring-like action into and amongst the fibres. (*See Journal for February.*)

2497. W. Squire. *Improved machinery for planing and shaping wood.* Dated Oct. ,5 1861.

Here the patentee planes the opposite faces of planks, &c., simultaneously, and thereby ensures perfect parallelism, by the use of a combination of machinery, wherein a pair of cutters, rotating in vertical planes, and capable of receiving a nice adjustment, operates simultaneously upon opposite sides of tbe work, which work is fixed in and carried forward by a travelling carriage. This carriage is so constructed as to hold securely either a single plank or block, and present the vertical sides to the cutters, or a pile of planks may be so packed therein as to present their edges to the cutters. By a slight modification, the machinery may be made to plane inclined faces, or by a change of cutters the machine may be adapted to cut mouldings.

2534. B. Browne. *A new improved spring.* (A communication.) Dated Oct. 10, 1861.

This consists of combination of steel blades or strips of tempered steel, bent in different curves or directions, the said blades being connected together at their extremities, so as to act one upon the other, so that when in use the end portions of the blades pressing upon each other stiffens the springs, and thus adapts them to the load or pressure they are required to bear or carry.

2562. F. B. Houghton. *Improvements in apparatus employed in reducing straw and other vegetable substances in the manufacture of pulp for making paper.* Dated Oct. 14, 1861.

Here the patentee employs a boiler of a cylindrical form with hemispherical ends, and within this boiler a shaft or axis works, passing through a stuffing box at one or both ends. On this shaft are fixed several bent or curved blades, the edges of which are bent up so as to form scoops; these blades are fixed at intervals all round the shaft, and they are of a length to come within a few inches of the inner surface of the boiler. To this shaftrotatory motion is communicated, by which the materials under operation are continously moved and raised out of the alkaline solution in the lower part of the boiler, which is about one-third filled with that fluid. The boiler is heated from the interior by water circulated in closed pipes or tubes, on Perkins' principle. When the boiler and the materials therein are to be cooled, water is pumped into the boiler.

2574. T. Forster. *Improvements in re-working waste vulcanized india-rubber.* Dated Oct. 16, 1861.

Here the vulcanized india-rubber is suitably reduced by crushing rollers, or otherwise, and is then mixed with gutta-percha and sulphur. Pigments may be added to the mixture of vulcanized india-rubber, gutta-percha, and sulphur, if desired.

RESULT OF THE PRESENT CONDITION OF OUR PATENT LAWS.

Board of Arts and Manufactures for U. C.,
Toronto, *May* 13, 1862.

Sir,—I have frequent applications made to me, as to whether Canadians can now obtain Patents in the United States, and on what terms. My impression has been that they cannot, since the passsing of the Act of May, 1861; will you be kind enough to inform me if I am correct; or, whether Canadians can still obtain Patents in the United States by paying the sum, formerly paid, of five hundred dollars.

I am, Sir, your obedient servant,
W. Edwards, *Secretary.*

The Hon. the Commissioner of Patents,
U. S.

U. S. Patent Office,
Washington, *May* 20*th*, 1862.

Sir,—In reply to your communication of the 13th instant, I have the honor to inform you, that as Canada discriminates in her patent laws against citizens of the United States, Canadian subjects are not entitled to the benefits of the tenth section of the Act of March 2nd, 1861, herewith enclosed.* Canadians can obtain patents only on payment of the fee required under the old law of all British subjects, viz., $500 on each application.

I am, Sir, respectfully your obedient servant,
D. P. Holloway, *Commissioner.*

W. Edwards,
Secretary of Board of Arts and Manufactures,
Toronto, Canada.

* See "Proceedings of the Sub-Committee," page 133.

Selected Articles.

LECTURES OF SPECTRUM ANALYSIS.

BY DR. H. E. ROSCOE, AT THE ROYAL INSTITUTION OF GREAT BRITAIN.

In our lecture last Saturday afternoon we investigated the properties of white solar light. We saw that the sunlight which produces upon our eye the impression of whiteness is, in reality, composed of an infinite number of different coloured lights; and we obtained, when we passed this white solar light through a triangular piece of glass, that which we called the solar spectrum—a broad band of variously coloured rays differing from one another in their refrangibility. But we noticed that this solar spectrum is not continuous,—that it is intersected by dark lines which run through the whole length of the spectrum, and which occur always in sunlight. We noticed that these bands occur not only in direct sunlight, but also in reflected sunlight—in the light of the planets, and that these same bands do not occur in starlight. Hence Fraunhofer, as early as the year 1814, stated that these lines observed in the spectra of the sun and planet-light must in some way have their origin in the sun. We then proceeded to notice the properties of the light given off by artificially heated bodies. We saw that, with the exception of phosphorescence, light is given off only when a body becomes heated; and we divided artificial light as given off from heated substances into two great classes,—namely, that kind of light which is given off when a solid or a liquid is heated, and that kind of light which is given off when a gas is heated. We saw that when a solid or a liquid body becomes luminous it gives off light of every kind between certain limits—that its spectrum is continuous; whereas the light given off by a glowing gas is not of every kind—that such light produces a broken spectrum; and thus we learnt that it was possible to distinguish, by examining the light given off by such glowing gases, between the kinds of gas which were made to glow, but that we could not in the case of liquids or solids decide by the examination of the light what substance was heated; and thus we arrived at a knowledge of the possibility of founding the science of spectrum analysis, a science which will teach us what the chemical nature of a substance is by simply looking at the kind of light given off by its glowing vapour.

I propose in this lecture to notice—for I cannot do more than notice—some of the applications of the principles which we laid down in the last lecture, to the analysis of terrestrial matter; for we find that we obtain, by the application of these principles to the examination of the matter which composes our globe, a knowledge which is as perfectly unlooked for and novel as it is interesting—information concerning the properties and chemical composition of the matter constituting the globe which we inhabit.

We must remember that what we require to do in order to obtain such a knowledge of the constitution of terrestrial matter, is to obtain this terrestrial matter in the condition of a glowing gas. Now, we may divide, for the sake of illustration, the matter composing the globe into three classes, —that matter which is made gaseous and which becomes luminous near the temperature of the coal-gas flame: that matter, in the second place, which is volatile at a much lower temperature than that; and thirdly, that matter which is volatilised, and becomes luminous at a much higher temperature than that of the gas flame.

Thus, for instance, if I place a piece of clean platinum wire in this gas flame for a few moments we shall observe that it does not impart any colour to the colourless flame. For a moment it does impart a colour, for a reason which I shall have to explain. The platinum itself does not give any colour to the gas flame because it is not volatile at the temperatare of the flame, and we do not get any platinum gas. But if I place another substance in the flame; for instance, a piece of common salt, we shall see that this flame is coloured of a peculiar tint, owing to the fact that the sodium is here volatilised, and that it becomes luminous, and gives off its peculiar and characteristic kind of light, namely, yellow. Now, by heating the platinum to a much higher temperature, we can get the peculiar light which it gives off. Thus, for instance, I have here a platinum pole, and by passing an intense electric spark through this, I obtain the platinum, as we shall see in a subsequent part of the lecture, in a state of luminous vapour, and then we find that the platinum also gives out the light which is peculiar and characteristic for platinum alone, and which no other body gives off.

That peculiar chemical substances produce in the flame peculiar colours has long been known, and this fact is used by the chemist as a means of detecting such substances. Thus, for instance, I will here show you a number of such differently coloured flames; here we can produce the luminous vapour of a number of these substances. I can here produce the characteristic yellow flame of sodium. If I bring the salts of potash into this flame I can produce the peculiar colour given by all those salts—a peculiar purple colour. Here I have the peculiar colour which is produced by a very interesting body with which we shall have to do in a subsequent part of the lecture—one of the new alkaline metals discovered by Bunsen, *rubidium;* and this is the flame coloured by the other new alkaline metal, *cæsium,* also discovered by Bunsen. Here we have lithium, which produces this magnificent red colour. Here we have the green produced by barium. All the salts of barium tint the flame of this beautiful green colour. Here we have the red produced by strontium. Here we have the orange produced by calcium, and here I will produce a peculiar blue flame by a substance which differs entirely from these in properties—the non metallic element selenium. If I bring selenium into the flame, we shall see that this body imparts to the flame a very peculiar and beautiful blue colour. It is extremely volatile, and only lasts for a few seconds. Further on we have the peculiar blue colours communicated to the flame by copper and by boracic acid.

I can show you the same thing in various ways. Here, for instance, I can produce a much larger flame, and show you the colour of the same salts. [A large gas flame was produced from a perforated jet of about three inches in diameter, and urged by a strong current of air. Pumice-stone dipped

in solutions of the chloride of sodium, potassium, barium, strontium, calcium, and lithium, were then held in the flame, the colours imparted by those substances being thereby again made evident.]

I will show you one more illustration of this with these papers. These are papers—gun-papers in fact, which have been soaked in nitric acid, and which have then been steeped in solutions of these various salts. Here you see we shall have rather a quick combustion, but by reflection on the white screen the colour will be shown very well. [The lecturer then burnt gun-paper which had been dipped in solutions of the chlorates of the following substances: sodium, potassium, barium and strontium.]

As I have said, it has been long known—that these various substances produce certain colours when brought into the flame. But if we now examine more closely what goes on when we have these variously-coloured flames burning before us, and what exact kind of light is given off; that is to say, if we examine the spectra of these differently coloured flames, we find that we obtain very much more information concerning the matter than we do in this simple way by looking at the flames themselves. We look through a prism, or we employ Kirchhoff and Bunsen's more perfect arrangement, which you see here in the actual instrument before you, or here in the drawing; and we place a bead of the salt, the colour of whose light we wish to examine, in the flames here in front of this slit, as indicated in the drawing. I here bring a bead of chloride of barium, into one of these flames placed at one side of the slit. The green light thus produced falls upon the small prism placed over the upper half of the slit, and it is thereby refracted so as to pass into the tube and through the large prism. Into the other flame, placed directly in front of the slit, I bring a bead of chloride of strontium, and the red light which this produces passes directly through the lower half of this slit on to the prism. In this way we obtain two spectra, one in the upper half of the field of the telescope, the other in the lower half; and we are thus enabled to compare very beautifully indeed the spectra which we wish to examine. Suppose, for instance, that we want to know whether a substance really is barium: all we have to do is to place the substance which we know to be barium in the one flame, and to place the substance which we suppose to be barium in the other; if on looking through the telescope we find that these two sets of lines actually coincide—that the lines of the substances which we know to be barium coincide exactly with the lines of the substance which we suppose to be barium,—we then arrive at a very distinct knowledge that the substance is really what we suppose it to be. If we examine with such an instrument as this, which is the latest form of Bunsen and Kirchhoff's apparatus, such a flame as any of those we see burning before us, we observe what is represented very faithfully indeed by these painted diagrams. If we look at the yellow sodium flame we notice that the sodium spectrum consists of one single bright yellow line, which, when we examine it more carefully with a larger number of prisms, we find is split up into two lines. Now, all the sodium compounds yield this peculiar spectrum; and nothing we know of, besides sodium and its compounds, will yield it. Potassium, which produced the purple flame we saw here, gives us a spectrum consisting of a portion of a continuous spectrum, with a bright line in the red and another in the violet. One of these lines is known as line *alpha* of potassium, and the other as the *beta* of potassium. These lines are not seen in any other substance, and they are seen in every potassium compound from which we can obtain this luminous vapour. Proceeding onwards, we find that we see the spectrum of lithium, consisting of one bright red and one orange line not so bright; and these three lower paintings—strontium, calcium, and barium—represent the spectra of those three alkaline earths. What we notice when we look at these flames through the telescope is exactly what is represented on that diagram.

Now, we may ask ourselves, "This is all very well but what improvement is this method of analysis upon our ordinary chemical methods? What benefit is it to us that barium gives us these peculiar bands, that strontium yields certain different bands, that calcium produces others again? We know that the reactions of calcium, barium, and strontium are very diffierent, and we can easily detect these substances by the ordinary chemical methods." The answer to this is, that this method is far more delicate than anything which has been hitherto used; that by means of this reaction we can detect such minute quantities that the delicacy of the method is almost past belief. I am sorry to say that I forgot to make an experiment with sodium to show you the delicacy of this process, because I am afraid that we have now so filled the room with that substance that we cannot get the reaction so delicately as I should like. I am afraid the flames will all burn now with the sodium reaction. I want to show you that dust contains sodium,—that we cannot take up a substance which does not contain sodium; and if I heat this platinum wire, we shall see that it contains sodium. The flame becomes distinctly yellow; and if I pass it between my fingers, you will see that my fingers contain sodium, and this you will see by the yellow colour imparted to the flame. I do not know now whether the dust from my coat will show the presence of sodium; it certainly would if the flame were not tinged by the sodium which is already in the atmosphere. I will try my coat. [The skirt of the lecturer's coat was dusted near the flame, and the presence of sodium in the coat-dust was rendered evident.] This is not because it is the coat of a chemist; the dust from a book will show us the presence of sodium. You see that there is sodium in the dust of this book; in fact, every substance contains sodium, and therefore we can understand how Bunsen could recognise the 180 millionth part of a grain of sodium, for this was the small quantity that Bunsen and Kirchhoff found could be easily detected. But not only can we detect such minute traces of substances, but we thus gain important information respecting the distribution of bodies. In illustration of this, I may mention that lithium—the body which gave us that magnificent red flame, and some of which we have here—was only known to exist in a very few minerals; but Bunsen, on examining the spectra of various substances, saw that this red

line, indicative of the presence of lithium, exists almost everywhere. He found it in the ashes of plants; and an experiment, which he is fond of showing, as illustrating the wide diffusion of lithium, is that of holding the end of the ash of a cigar in a colourless gas flame, and showing his friends the occurrence of the red lithium line, when the flame is observed by means of this instrument. We thus see that lithium is contained in the ashes of tobacco, in the ashes of many other land plants, in the oldest formations, in granite, and in the blood of animals. Instead of being, as was formerly supposed, a most sparingly-diffused substance, it is one which occurs almost everywhere; but owing to the small quantity of the substance present, it had been overlooked by our rougher and less exact methods of research. The crowning point of this investigation is, however, that of the discovery of two new alkaline metals by Bunsen.

Bunsen, on examining the alkalies contained in the waters of Dürkheim, in Rhenish Bavaria (he had previously separated, by chemical means, all the other bodies from the water, and the substances which were left could only be alkaline substances), saw, on looking at the spectra produced by these, some lines which he had never seen in the spectra of any alkalies before; and he said, "There is a new alkaline metal contained here; this appearance must be produced by some new elementary body;" for no other substance which he knew of, or which he had examined, had ever given these lines before. Now, in a very interesting paper on these two new metals, which he calls rubidium and cæsium,—for reasons I shall explain to you presently,—Bunsen says that from 30 grammes of the mother liquor he obtained only 1·2 milligrammes of the impure salts of these two new alkaline metals. That was all he had to begin with, about the one-hundredth part of a grain; but still, so sure was he of this method, and so certain was he that his spectrum never failed him, that he set to work at once and evaporated down 50 tons of this water to get some more of this substance. 44 tons yielded him only 105 grammes of the chloride of rubidium, and 70¼ grammes of the chloride of cæsium; so that out of 44 tons of water he got only about 200 grains of the mixed chlorides of these two new metals. Here I have a small specimen of the salts of cæsium, kindly sent to me by my friend Prof. Bunsen. I have, however, more of the rubidium salts, which now can be obtained in larger quantities from the mineral lepidolite which I have mentioned. Bunsen, then, by the inspection of the spectra of these new alkaline metals determined their presence, and afterwards, having seen these lines, set to work to separate out the metals which caused them.

I will, with your permission, first show you the spectra of potassium and sodium, and afterwards the spectra of the new alkaline metals, Mr. Ladd will be kind enough to show us with the electric light these spectra; but you must not suppose, ladies and gentlemen, that what we get on the screen is exactly what we observe when we look through Bunsen's apparatus, which is adapted specially for analysis; but the results are extremely beautiful and interesting, and, I think, we shall see the distinguishing difference between the salts of rubidium and potassium. I will draw your attention, first of all, to the paintings representing the spectra which we are about to see. Rubidium and cæsium both possess spectra analogous to the spectrum of potassium. The difference in the spectra is but small. The potassium, as I have told you, gives a partially continuous spectrum; rubidium also gives a partially continuous spectrum; and the cæsium likewise gives a partially continuous spectrum; but at either end of all three spectra we find red lines in the least refrangible part, and violet lines in the most refrangible part; the two red rubidium lines are less refrangible than the potassium line, and these red lines [pointing to the diagram] do not exist in the cæsium spectrum. Bunsen has chosen two names for these two metals—cæsium from *cæsius*, a greyish colour, and rubidium from *rubidus*, red, owing to lines of these colours being characteristic of the presence of these two metals.

Here we shall get the sodium spectrum; but I warn you that you will see other lines besides those given by sodium. The bright orange line is due to sodium. The sodium spectrum produces this bright orange line, which is alone seen here when we look at it through the more delicate instrument, and use a finer beam of light and a finer slit. We then see that the sodium spectrum consists solely of two bright yellow lines, which are separated by a very, very slight interval, and each of which is as fine as the finest spider's web. We cannot, unfortunately, exhibit the sodium lines in that way. There you see the splendid spectrum in which the orange band of sodium is very markedly visible. The other lines are not those which we have to attend to at present. It is impossible here, owing to the fact that our carbon points are impure, and contain certain metals mixed with the carbon, to get the pure spectra of the metals; and with this smaller apparatus, unfortunately, we cannot get light enought to throw the spectra on to the screen.

We now have the potassium spectrum, we still see the yellow band of sodium, because, as I have told you, sodium exists everywhere, and it is almost impossible to get the potassium pure; but we shall likewise see two other lines. There is the bright red band at one extreme end of the spectrum, and a violet one at the other end. These two are due to potassium. You notice also that the spectrum is continuous in the centre.

Now, we will take a mixture of potassium and sodium; such a mixture I have here. The mixture contains one part of sodium and twenty parts of potassium, yet the yellow colour of the sodium will cover entirely the purple colour of the potassium; and when we look at the flame with the naked eye we shall see nothing but the yellow flame, which might be produced by pure sodium. [A portion of the mixture was held in the gas flame, to which a bright yellow tint was communicated.] You see this flame is as yellow as if it were pure sodium, yet it consists of one part only of sodium and twenty of potassium. But if we bring this mixture into the apparatus, and if we look at its spectrum, we find that the light of the sodium is kept to its own position. We have the bright yellow line of the sodium which does not interfere with the lines of the potassium, and these come out as distinctly as though no sodium were present at

all. By allowing the bright sodium line to appear only where it ought, we see both the potassium lines coming out most beautifully.

Bunsen most eloquently describes, in his Memoir on this subject, the spectra which he sees when he places in the flame a mixture consisting of the chlorides of potassium, sodium, lithium, barium, strontium, and calcium, of each of which substances there is present only the one-thousandth part of a grain. He sees, first of all, the spectra of those substances which are most volatile appearing; the salts of sodium, potassium, and lithium are first seen; their spectra first come out, and these gradually fade away, and the spectra of calcium, strontium, and barium appear in all their vividness. Now, unfortunately, I cannot show you this with the beauty in which it is seen in the instrument when we allow the rays to fall on the retina; but you can see something which is very magnificent indeed. The mixture of all these chlorides together we now place in the carbon cup, and on bringing the upper carbon in contact with the mixture we shall volatilise the compounds, and we shall obtain the super-imposed spectra of all these substances. Mr. Ladd has now placed all the mixed chlorides in the cup, and on making contact we shall have all the lines appearing. There you see what splendid bands we get now, and you will observe that some of the bands will gradually disappear, the light remaining constant; and others will appear with greater brilliancy, because the more volatile of these salts are driven off. There you notice the bright green bands of the barium. That splendid blue line is produced by strontium. Here we have the sodium; that is the green line of calcium; here we have the bright and red line of lithium.

Now, how did Bunsen separate these new metals from one another, and from the old alkaline metals? I must give a moment to this point. In the first place, unless we could examine the spectra of cæsium and rubidium, we probably should never have discovered their existence at all. There is no doubt now that one at least of these newly-discovered substances has been handled by chemists before, but mistaken for potassium, in a certain mineral called lepidolite, which was known to contain lithium, and has now been found to contain a large quantity of rubidium. Rubidium and cæsium are so much like potassium in their chemical characters that, if it were not for this difference in the spectra we should never have succeeded in separating one from the other, or in detecting any difference between these substances when they were present together.

I can show you that rubidium and potassium are closely analogous. Here we take a solution of chloride of platinum. We know that it produces with potassium compounds an insoluble precipitate, and thus we distinguish these from the sodium compounds with which no such precipitate is produced. We shall at once get, as you will see, a quantity of this bright yellow precipitate of the double chloride of platinum and potassium.

Exactly the same thing we shall see will happen with rubidium. Here I have a solution of the chloride of rubidium I add a few drops of this solution of chloride of platinum, and immediately we get a precipitate of the double chloride of platinum and rubidium. We cannot in the outward appearance see any difference between the precipitate formed by the rubidium and that formed by the potassium. This is one of the reactions by which we distinguish potassium from sodium, but you see we cannot in this way distinguish potassium from rubidium. We can make a similar experiment with tartaric acid. If we take some chloride of potassium and some chloride of rubidium, and add to each some tartaric acid, we shall obtain with both a white precipitate of the insoluble bitartrate.

But we can distinguish these new metals from potassium, and separate them by a difference of property which is exhibited by these platinum salts. We can distinguish them in this way: Here I have a solution in water of the double chloride of potassium and platinum. I will place some of this in both of these glasses. You will notice that when I add some of the chloride of potassium to this (the potassium bichloride of platinum) we obtain no further precipitate; it is impossible that we should thus obtain a precipitate; but if we add some chloride of rubidium to the potassium bichloride of platinum solution, we shall get at once a yellow precipitate showing that this double chloride of potassium and rubidium is much less soluble than that of potassium and platinum. This is the way in which Bunsen separated rubidium and cæsium from potassium. Bunsen then investigated the salts; and we now have a Memoir, written by himself and Kirchhoff—the second Memoir on Spectrum Analysis—which contains a very elaborate and beautiful description of their researches on this subject. We are now acquainted with the nitrate, with the sulphate, with the carbonate, with the oxalate, with the hydrate, and even with the two new metals themselves; so that we have a chemical history of those two substances, which we must teach in future in all our classes. I must mention also that both rubidium and cæsium form salts which are isomorphous with the potassium salts; they crystallise in the same form, and they possess an analogous composition. Cæsium can be separated from rubidium by the solubility of the carbonate of the former metal in alcohol. The atomic weight of rubidium is 85·36, that of cæsium is 123·35.

We cannot see the end to which the application of this principal may lead. During the first few months it has led to the discovery of these two new metals, and we have not only their spectra examined, but also are acquainted with most of their salts. Another observation which shows us how rich is the field of inquiry, is, that a new elementary substance has probably been discovered by Mr. Crookes. He has not yet succeeded in preparing a large quantity of the body, and thus proving its chemical characteristics distinctly, but he has prepared a substance which seems to differ in its chemical characters from all the other elements, and gives a totally different spectrum, consisting of one bright green line. Much is not known at present about this substance, but there seems very little doubt that it will turn out to be a new chemical element, to be added to the rather large family of elementary bodies.

James Watt described and sketched a "spiral oar," or screw propeller, in 1770.

A NEW PROJECTILE FORCE.

BY THOMAS M. MESCHIN, D.C.L., F.S.A., OF THE INNER TEMPLE, BARRISTER.

Water may be decomposed into its constituent elements, oxygen and hydrogen gases, either by voltaic electricity, by common electricity, by magneto-electricity, or by thermo-electricity.

Ist. BY VOLTAIC ELECTRICITY.—When the electrodes of a voltaic battery are brought near each other, in acidulated water, or, in other words when water is made part of a galvanic circuit, so that the current of electricity passes through it, decomposition ensues—its constituent elements, oxygen and hydrogen gas, are evolved at the electrodes.

2nd. BY FRICTIONAL ELECTRICITY.—Water may also be decomposed by passing a succession of discharges of common electricity through it. This was accomplished as early as 1789, by Messrs. Dieman Paetz and Von Troostwych. Professor Faraday and Mr. Goodman have also succeeded in obtaining true electro-polar decomposition of water by the action of frictional electricity.

3rd. BY MAGNETO ELECTRICITY.—Water can also be decomposed by a magneto-electric apparatus, for if it be made part of the circuit, as often as the circuit is completed, a current of electricity passes through the water, and the gases are thereby evolved.

4th. THERMO-ELECTRICITY.—Water is very easily decomposed by a thermo-electric pile, the electrolysing action of which is maintained by keeping the ends of the bars of which the pile is composed, the one at a high and theother at a low temperature.

The different forms of electricity known under the above names, may be used either separately or simultaneously for the decomposition of the water in the gas generator.

When this evolution of the gases takes place in a close vessel, or gas generator, a gradually augmenting compression necessarily results, which does not affect the evolution of the gases in the slightest degree. An exceedingly high pressure may thus be obtained in the gas generator or close vessel. Dr. Daniel raised it to the enormous tension of 56 atmospheres, or 840 lbs. on the square inch.

In the "Philosophical Transactions of the Royal Society, 1839," vol. 129, p. 93, 94, Professor Daniel thus describes an experiment:—"The evolution of gas, which was measured at short intervals, took place with perfect regularity, and did not appear to be in the slightest degree affected by the gradually increasing compression. In four. and a half minutes, when 19 cubic inches had been collected, the compression tube burst with a loud explosion, and the fragments, which were very small, were scattered all over the laboratory. If we were to calculate that 19 cubic inches were compressed into three tenths of an inch space unoccupied by the liquid, this would be a compression of 63 into 1, and the pressure would amount to 940 lbs. on the square inch; but if we reckon, as was probably the case, that two cubic inches of the gases were kept down by the solvent power of the liquid at this high pressure, then the compression would have amounted to 56 into 1, and the pressure to 840 lbs. on the square inch."

Electric Gas Gun.

The gases evolved at a high pressure from the decomposition of water by electricity, constitute a projectile force of very great intensity. By using them in the same way that air is employed in an air-gun, the greatest conceivable force may be impressed upon a projectile, a force, apparently, only limited by the strength of the materials of which the gas-generator is composed. Gunpowder is itself only a highly inflamable mixture, which, on being ignited, is rapidly converted into gases at a high pressure, and the gases in the electric-gas-gun would act upon the projectile in precisely the same way as the gas resulting from the ignition of gunpowder acts upon a similar projectile in an ordinary cannon; thus the force of gunpowder and that of these gases are analogous.

As to the form of an electric gas gun, it is similar to a breech-loading cannon. Attached to the breech is a reservoir, or gas generator, in which water is converted into the gases at such high pressure as the officer in command may deem requisite. There is a communication between the gas-generator and the barrel or chase of the weapon, which can be opened or closed at pleasure, but which, if not closed before, will close of its own accord, when the full charge of the weapon has passed into the barrel. This is accomplished either by a slightly conical piston or spigot, acting in a small hole through the barrel of the weapon, so placed that when a shot has passed over the point where it is situated, the gases press upon this piston or spigot (which is kept down by a spring,) and raising it by their pressure, it acts by suitable mechanical contrivance upon the apparatus for closing the communication; or by making the shot, when it passes over a certain point in the bore, complete and break an electric circuit, which acts by suitable machinery upon the apparatus for closing the communication.

An apparatus for closing this communication is so constructed, that when it is completely closed, and not by any probability till then, several electric sparks are passed through the gases in the barrel, which result in their explosion, and the discharge of the weapon, for I should have mentioned that these gases are endowed with a second element of force—they may be combined by an electric or other spark; or the gases may be exploded as gunpowder by the percussion of ordinary detonating powder. In combining they expand to fifteen times their volume. When the shot has, by passing from the breech to the muzzle, attained the uniformly accelerated velocity due to the high pressure of the gases, and is on the point of leaving the weapon, if the gases be then exploded the explosion will impress a force upon the shot equal to fifteen times the pressure of the gases. The small portion of pure water, which is formed by the combination of the gases, is condensed like dew on every part of the bore, and serves to lubricate the weapon, or, according to the temperature of the barrel, remains in the form of vapour, and is driven out by the succeeding discharge—the barrel never needs cleaning. At the breach there is an aperture through which the shot is introduced into the barrel with great rapidity after each discharge, by means of a very simple piece of mechanism. The aperture has its edges bevelled outwards to insure the fitting of the piece that fills it up when the shot is

introduced; there are several of these pieces accurately fitting this aperture, connected by each other by suitable links, and forming an endless chain. When the weapon is in the act of being discharged, there is a strong band, nearly half the circumference of the barrel, which is so fastened by adequate mechanical contrivances, that on the recoil of a gun after the discharge, the band is loosened by the action of the recoil, and the piece occupying the aperture falls out, and another piece bearing a shot, is brought by the action of the recoil of the weapon up an incline, under the aperture, which piece, by the return action of the weapon down the incline, is, with the shot upon it, forced into the barrel, and the band again fastened by the same return action. The shot is delivered from a hopper or reservoir of shot, (or may be placed by the hand) upon one of the pieces, by means of and during the upward action of the recoil. Instead of the band or in conjunction with it, a strong bar may be used, attached by a sort of hinge to the weapon, near the muzzle, and so arranged that when the weapon is being discharged, the end of the bar presses, with the whole weight of the weapon, against the piece occupying the aperture so as to resist the force of the gases, and when the weapon reccils, the pressure of the bar against the piece ceases and suffers it to fall out, and the next shot is introduced in the manner before described, whereupon the bar is made, by suitable mechanical contrivances, to resume its pressure against the piece by the return action of the recoil.

It is intended that the weapon shall be loaded, aimed, discharged, and entirely worked by machinery, and that the weapon and its whole working shall be capable of being fought, and controlled by a single man.

The force thus developed would seem to be the best possible force to which a projectile could be subjected—a uniformly accelerated force while moving along a rifled barrel, and then (when it has received from the rifle bore a motion round its axis) an almost instantaneous accession of immense force. It is quite obvious that these conditions are much more favourable for allowing the length of the bore or barrel of the weapon to be increased, and thereby securing greater precision of aim, and are also more favorable for the preservation of the weapon, than when the projectile is, as in the case of gunpowder, subjected to a constantly increasing and then to a constantly diminishing force. It is not, perhaps, too much too say, that a rifled electric gas gun would wear as long as a couple of rifled cannons in which gunpowder was used.

Sir H. Douglas says (p. 47),—"The main principle which should govern our choice of naval guns is, to prefer those which, with equal calibre, possess the greatest point blank range; and the practical maxim for using them should be to close to, or within that range, and depend upon precision and rapidity of fire. This is the most simple and most efficacious use of artillery."

An electric gas gun, if wrought by machinery, would have the greatest possible precision, and its rapidity of fire might rival that of a revolver; and it is perfectly obvious that it might be lengthened to any extent, so as to secure the greatest attainable point blank range.

"It is known, both from theory and practice," says Sir Howard Douglas (p. 96), "that with equal charges, and guns of equal weight, but of different lengths, the velocity of the shot increases with the length of the bore." Now these gases are much more capable of being used in weapons with great length of bore than gunpowder, because shot is driven from the breech to the muzzle, not, as in gunpowder, by a constantly increasing, and then a constantly diminishing force, but by a uniform, or nearly a uniform force, which is perfectly under command, and then is subjected to an explosive force; these are the very properties in a projectile force most favourable to precision, and the greatest point blank range. From practice at Deal, in 1839, with 32 pounder guns, one 9 ft. 6 in., and the other 6 ft. 6 in. long, with charges of 6 lbs., and windage of ·175, the elevation being one degree, the range of the longer gun was 853 yards, while that of the shorter one was only 734 yards.

These experiments show the very important effects resulting from a lengthened bore, but, owing to the nature of gunpowder, the limit to the length that can be used in practice is soon reached; but the case, as respect the gases, is wholly different; there is nothing whatever to prevent that length being adopted, in the electro-gas gun, which will secure the maximum result.

These gases have another great and pre-eminent advantage over gunpowder, viz., that the force impressed upon the projectile may be varied according to the work intended to be done by it. If a *ricochet* is required, only a small quantity of the gas may be admitted into the barrel of the weapon; no time need be wasted in altering the charge, the officer in command may increase or diminish the intensity of every succeeding shot without the slightest difficulty or delay. This would be in the highest degree useful, as well as economical, in finding and altering ranges—useful when a tentative process was desirable; economical, because the angle of elevation which gave the maximum result for the minimum expenditure of gas might be given to the weapon, and the charge varied with the required range.

From the experiments of Robins and others, it appears that when gunpowder is ignited, one-half of it is converted into gases (the principal of which are carbonic acid and azote) and the remaining half assumes the form of solid matter. If the powder be loose, the volumes of the gases are from 236 to 260 times that of the powder; in rammed powder from 480 to 520 times the volume of the powder. As to the expansion of the gases due to the elevated temperature at which they are generated by the ignition of the powder, the estimates are widely dis-similar. Robins set down the absolute explosive force of gunpowder equal to 1,000 atmospheres, that is, a pressure of 14,722 lbs. on the square inch; Hutton put it at 2,200 atmospheres, or 32,388 lbs. on the square inch. It is obvious that a considerable portion of the heat is absorbed by the gun.

With respect to the air-gun, the *Encyclopœdia Metropolitana* remarks, adopting the estimate of Robins, "if the air-gun be condensed ten times, the velocity will be equal to one-tenth of that arising from gunpowder; if condensed twenty times, the velocity would be one-seventh that of gunpowder and so on. Air-guns, however, project their balls with a much greater velocity than that assigned

above, and for this reason, that as the reservoir of condensed air is commonly very large in proportion to the tube which contains the ball, its density is very little altered by passing through that tube, and consequently the ball is urged all the way by nearly the same force as at the first instant; whereas the volume of the gas arising from inflamed gunpowder is very small in proportion to the barrel of the gun, and by dilating into a comparatively small space as it urges the ball along the barrel or tube is proportionately weakened, and it always acts less and less upon the ball in the tube. Hence it happens that air compressed only ten times into a large receiver will project its ball with a velocity little inferior to gunpowder."

What is here said of air applies with equal force to the gases. Besides, the ignition of the charge of gunpowder is not instantaneous; it is progressive operation, so that the ball when projected by gunpowder is subject, when passing from the breech to the muzzle, first to a constantly increasing, and then to a constantly diminishing force.

It will be interesting to contrast the cost of gunpowder and of the gases. The length of a 68-pounder is 9·49 feet; the effective length is less by the semi-diameter of the bore, which is 8·12 inches —the length is, therefore, 9·11 feet, and the capacity 4·41 feet. As a ton of zinc evolves 1966 cubic feet of the gases under a pressure of ten atmospheres, and as its price varies from £20 to £30, the cost per round of shot, out of a 68-pounder would be as follows, under the following pressures. At—

10	atmospheres	0s.	9d.	at £20—	1s.	4d.	at £30.
20	"	1	9	"	— 2	8	"
40	"	3	7	"	— 5	4	"
60	"	5	4	"	— 8	0	"
80	"	7	2	"	— 10	9	"
100	"	8	2	"	— 13	5	"

Now, if the *Encyclopædia Metropolitana* be correct in saying that air, compressed ten times, will project a ball with a velocity little inferior to gunpowder, surely these gases, when compressed ten times, that is, to a pressure of ten atmospheres, and exploded, ought to rival and surpass gunpowder, as they would, in addition to the force due to the ten atmospheres, impress a force on the projectile, at the moment of its flight, fifteen times that pressure. But when contrasting the cost of the gases as a projectile force, and that of gunpowder, it is safer to be under, rather than over the mark, so then, notwithstanding the *dictum* of the *Encyclopædia Metropolitana*, we will base our calculation on the assumption that the gases condensed 20 times, and developing on their explosion a force equal to 300 atmospheres, will produce effects equal to those of gunpowder; the cost for shot will, as we have just seen, be from 1s. 9d. to 2s. 8d.

The cost of gunpowder varies, of course, with the price of the articles from which it is manufactured; it ranges from one to two shillings per lb. A 68-pounder takes 16 pounds for a charge; the cost per shot is therefore from 16s. to 32s., consequently the gases are by far the cheaper force, for even at 100 atmospheres they would only cost from 8s. 2d. to 13s. 5d., scarcely one-half the price of gunpowder, but at 20 atmospheres they would scarcely be one-tenth of the price.

Gunpowder is deteriorated or destroyed by the absorption of moisture; this could not happen to the gases. This absorption of damp is a constant cause of "great and unknown losses of strength," and a little more or less moisture will alter most materially the accuracy of practice. Attempts to protect gunpowder from moisture are a constant source of heavy outlay, which should be borne in mind when comparing the relative cheapness of the forces, and "no degree of care" can altogether preserve it from receiving some injury. (Sir H. Douglas.)

Then the force impressed upon the projectile might be increased *ad libitum*. This cannot be done with gunpowder, for if the charge be increased beyond a certain point, a diminution of force results, as part of the powder is shot away unignited, and the powder ignited acts for a shorter space on the ball, but in the electric-gas gun the pressure may be raised to any point in the gas generator so as to impress the required force upon the projectile; thus, if it was found that a 100-pounder, propelled by a force equal to that of gunpowder had no effect upon an iron-plated vessel, the force might be doubled or trebled until the desired result was achieved! indeed, it is probable that these weapons would settle the question of armour-plates, because if, as Mr. Scott Russell holds, the thickness of the plates cannot be usefully increased beyond 4½ inches, as soon as a weapon is constructed of sufficient force to destroy this armour, it will cease to be a protection, and will only insure the sinking or capsizing of the unlucky vessel it was intended to protect, like the knights of former days, whose armour at last became so heavy that, if they chanced to be unhorsed, they were compelled to lie prone, unable either to renew the fight, or to consult their safety by a retreat.

It may be observed that it would be difficult, when the firing proceeded from works in any way extensive, or from masked batteries, for an enemy to discover the precise point where one of these weapons which threw the projectiles was situated, as there would be smoke and no report (for a vacuum would be formed by the explosion of the gases). In most cases this would prove of signal advantage, among others—as not affording a mark for the shot of the enemy, should he seek to disable the weapon. Besides, the absence of smoke would not interfere with the aim of other weapons, and the absence of noise would enable the orders given by those in command to be distinctly heard.

There would be practically no report; the report, such as it would be, could not be heard beyond a few yards—it would be 500 times less than that of a cannon, and 10 times less than than that of an air-gun.

When a cannon becomes heated by repeated discharges of gunpowder, the elasticity of the metal of which it is composed is diminished, and the properties of the weapon are impaired. It is probable that rifled cannon (other things being equal) are liable to be more quickly heated than those with a smooth bore, owing to the fact that the ball meets with greater resistance in moving along a rifled bore than a smooth bore, and consequently consumes more time in reaching the muzzle. The barrel of t e weapon is therefore subjected for a longer period to the action of the highly heated gases evolved by the ignition of the gunpowder. This result could not arise from the action of the

gases in the electric gas-gun, for the heat evolved by the detonation of the gas is by no means great. The electric-gas gun is therefore so far as this point is concerned, the more perfect weapon, being capable of more incessant and prolonged work.

The electric-gas gun is eminently suited for being wrought by machinery, thereby securing greater precision of aim, greater rapidity in firing, and enabling one man to accomplish the work of many. The recoil of the gun might also, if necessary, be turned to account, in increasing the condensation of the gases, and for the purpose, when requisite, of forcing water into the gas generator when the weapon is in action, to replace that consumed by discharging the weapon. This may be accomplished by a plunger, similar to that of a Bramah press, moving in the place of the recoil.

An electric-gas gun, if wrought by machinery, might be made to cover an object as accurately and with as much precision as a theodolite, the rapidity of its discharge might be made to rival or surpass that of a revolver, only it would be continuous and not limited, as in a revolver, to half a dozen rounds and it would be as much under the control of one man as the most gigantic of our steam-engines. The machinery for the weapon might be wrought by a donkey engine, the cylinders of which could be supplied from the gas generator in the manner mentioned below. In a fortress or ship defended by a few such weapons, one man might do the work of fifty.

In the interests of peace, it is no small recommendation in favour of these weapons that they are more calculated for defence than for offence.

The steam-gun, as is well known, throws its projectiles with great rapidity. Now if the gases of which I have been speaking were substituted for steam they would be much more efficient; firstly, because a higher pressure could be obtained with much less danger; and, secondly, at the moment the projectile was leaving the tube or barrel the gases might be exploded, thus impressing upon the ball or projectile an augmented force fifteen times greater than that to which it is subjected in the American steam gun; consequently the ball or projectile would be at least fifteen or sixteen times more effective under the action of the gases in an electric gas gun, that is under the action of the steam in the steam-gun.

A cubic foot of water produces at the mean pressure about 1,980 cubic feet of the mixed gases—that is, about 1,320 cubic feet of hydrogen gas, and 660 cubic feet of oxygen gas, or nine pounds of water produce eight pounds of oxygen gas and one of hydrogen. A cubic foot of water produces 1,700 cubic feet of steam at the mean pressure of 212° Fahr. The relative volume of the gases, at that pressure and temperature, would be 2,572 cubic feet, so that the advantages are on the side of the gases in this point very decidedly.

In a fortress defended by these weapons there would be no need to tremble for the safety of the gunpowder magazine, and the apparatus for supplying the electricity might be placed out of reach of harm. And now as to cost, after the first cost of the requisite apparatus has been defrayed, the cost of maintaining the electrolyzing action in the gas generator will mainly depend, if voltaic electricity be used, on the value of the materials consumed in the battery as compared with the value of the products of the battery. If common electricity be employed, its cost will be measured by the amount of mechanical effort necessary for its development. If magneto-electricity be used its cost will depend upon the mechanical force requisite to keep the magneto-electric machines in action. If thermo-electricity be employed its cost will depend on the expense incurred in keeping the extremities of the bars of the thermo-electric piles at different temperatures.

The advantages of these electric-gas guns, as compared with gunpowder guns, are:—

1. The projectile force employed is very much cheaper than gunpowder.
2. Its practice is more certain and uniform, not being liable to be affected by damp, &c.
3. It is more under control; the force with which a projectile is driven may be diminished or augmented at pleasure.
4. It is capable of being wrought by machinery (driven by the gases from its own gas generator), thereby ensuring greater precision of aim, greater rapidity of firing, and enabling one man to do the work of many.
5. It is less dangerous, both to the men who work it, and to the ship or fortress which it defends, as it needs no powder magazine, which might be blown up by shot, shell, or lightning.
6. A force is applied to the projectile more favourably, resulting in less strain upon the weapon, and its greater durability; besides, not being liable to be heated, it is the more perfect weapon, being capable of more incessant and prolonged work.
7. The discharge being accompanied with neither smoke, flame, nor report, it could not afford a marked object for the enemy's shot.
8. Its superior powers of horizontal or point blank firing at low elevations, "the best test of the real power and value of a gun," "its real service value."

The Electric-Gas Shell.

The gases, evolved by the decomposition of water by electricity, may be forced, at a very high pressure, into metal shells, similar to shells used for offensive operations in war, the shells being so constructed that on striking any body, an electric spark, or detonating spark, could be elicited, which would result in the detonation of the gas and the bursting of the shell.

Then these gases might be used with other bodies in the shell, gaseous, liquid, or solid, that would contribute to augment the violence of bursting.

A NEW MOTIVE FORCE.

When gases are maintained at a high pressure or tension in a vessel, corresponding to the boiler of a steam engine, they will, if admitted into a cylinder, press upon the piston, and perform all the functions discharged by steam in working an engine.

Electric Gas Engine.

Gases generated under a high pressure, by the decomposition of water by electricity, will act fully as effectively as steam when admitted into the cylinder of a steam engine. The pressure may be raised to a point at which it would be perilous to

work steam, owing to the facility with which the strength of the reservoir may be increased. Then, no additional cost is incurred by working at the highest pressure; precisely the same electro-motive force is expended in effecting decomposition at all pressures. Thus the strength of the gas-generator is the only practical limit to this enormous force, the real obstacle to its most economical application, an obstacle which doubtless will gradually yield to the ingenuity of engine manufacturers.

These gases may be wrought expansively, which will result in very great augmentation of the work done by the engine, for the same expenditure of electro-motive force.

After the gases, by passing through the cylinder, have impressed upon the piston the force due to the pressure under which they are generated, they may be utilized in either of the following ways:—

I. By detonating the gases after they have expanded; while in the cylinder, they may be combined by an electric spark. In combining they expand to fifteen times their bulk, and consequently impress a force on the piston equal to fifteen times the pressure which the gases exerted. A heavy fly-wheel would prevent the loss of *vis viva* which might attend the suddenness of the application of this force.

When the gases are combined by an electric spark, they are converted into water, and a vacuum results similar to that occasioned in a condensing steam engine by the condensation of the steam. By the vacuum which is thus formed by the combination of the gases, the advantages of the high-pressure and condensing steam engine may be combined in the electric-gas engine.

The sources of force are, therefore, threefold.

1st. The high pressure in the gas generator, which may be taken at 50 atmospheres, or 736 lbs. to the square inch, although in high pressure steam engines it rarely exceeds 120 lbs. There can be little doubt but that the reservoir might be readily constructed sufficiently strong to work safely at a pressure of 60 or even 100 atmospheres, particularly when all the inducements which economy can hold out are on the side of high pressure in the electric-gas engines.

2nd. The expansion of the gases to 15 times their volume exerts a force on the piston.

3rd. A vacuum which will give a useful effect of from 13 to 14 pounds per square inch.

II. The combustion of the gases after passing through the cylinder, may be employed for heating the gases in the cylinder while expanding, and thereby increasing their elastic force; it is obvious that this heating process must be applied while the gases are in the cylinder, for no advantage would accrue from increasing their tension in the gas generator, as they can be evolved at the highest possible pressure there without additional expense, but if they be heated while expanding, it is obvious that the work done by them would be much increased.

III. By burning the gases after passing the cylinder, for the development of thermo-electricity, to be employed in aid of the electricity used in decomposing water in the gas generator.

IV. By using the gases after passing through the cylinder for the purpose of developing electro-motive force, to go in aid of that employed in decomposing the water in the gas generator, theoretically the electro-motive force developed by the combination of the gases ought to decompose an amount of water equal to their own weight. This is, I believe, the theoretic effect of Groves gas battery.

Thus, then, the gases, after being used in the cylinder, may be employed in one of three ways: —1. For the production of an electro-motive force by thermo-electricity or by voltaic-electricity. 2. For the production of a detonating force, and the resulting vacuum. 3. For increasing by their combustion the tension of the gases in the cylinder.

It may be observed, that in an electric gas engine the gases may be wrought expansively, which will not only result in considerable saving, but will also materially diminish the possible practical inconvenience of the detonation of the gases in the cylinder; if, for example, the gases were wrought at 50 atmospheres, and were allowed, before being detonated, to expand in the cylinder till the pressure was one quarter of an atmosphere, the pressure on the piston when detonated, would be less than one-twelfth of the initial pressure of the gases in the cylinder; what the proper amount of expansion to be allowed is, would very soon be practically determined, when the electric gas engines come into operation.

The strength of the reservoir, or gas generator, in an electric-gas engine, corresponding with the boiler in a steam engine, might be increased to almost any amount required; the difficulties which prevent the strength of a steam boiler from being increased beyond a certain point could not operate as regards a gas generator. One of the main objects kept constantly in view in the construction of a steam boiler, is the securing the largest possible amount of heating surface; now the strength of a boiler is the strength of the weakest part of it, consequently, as its surface is extended, the chances of a flaw or weakness in some part of that surface are increased; then if the thickness of the plates were unduly increased it would interfere with the action of the fire. The rivetting of the plates is estimated to reduce the strength one-third. The highest tension attained in high-pressure steam engines scarcely, if ever, exceeds eight atmospheres, or 120 lbs., per square inch; in an electric-gas engine, the highest pressure may be maintained in the gas generator at precisely the same cost as the lowest; consequently, the higher the pressure the less the expense for equal amounts of work done. With regard to the construction of the reservoir, or gas generator, the form of greatest strength may be adopted, and the thickness of its parts augmented to any conceivable amount.

If necessary, to obviate any danger that might possibly arise from the accidental detonation of the gasses in the gas generator (if such a thing be possible), the gas generator may be divided into compartments, in which each gas may be kept separate, thus rendering such a detonation wholly impossible. With regard to the cylinder, it may, if found requisite, be divided, during the first part of the stroke, into two separate compartments, proportioned in capacity to the respective volumes of the two gases, but so as that during the latter part of the stroke, the gases may become mixed,

so as to be, if necessary, detonated by an electric or other spark.

The time must come, if it has not already arrived, when electricity will be produced more cheaply than steam. Every mechanical and chemical change which takes place in bodies, results in setting free some electricity; thus, if two bodies are in contact and they are suddenly removed, there is an electrical disturbance. When water boils electricity passes off in the steam. The fire in the grate and the flame of the gas-lamps are evolving electricity.

Every chemical change in the constitution of bodies results in the development of electricity. A galvanic battery merely collects and applies the electricity evolved by the chemical changes going on in its cells. If some method could be discovered of making the products of the chemical action in the battery as valuable, or nearly as valuable, as the zinc or agents of which the battery is composed, the great problem would be solved, and electricity might take its place side by side with steam as a practical motive force.

In conclusion, I may observe that the proposed electric-gas engine and electric-gas gun are original ideas. It first struck me that electricity might be used as a motive force about 1849, when attending the lectures of a most able and amiable gentleman, whose admirable Treatise on Heat ranks him high amongst modern philosophers.

I may also perhaps mention that I gave notice, before the meeting of the British Association in last September, of my intention of reading a paper on this subject, but was prevented, by unavoidable circumstances, from going to Manchester.

44, Chancery Lane, London.

THE MANUFACTURE OF LEATHER CLOTH.

The manufacture of leather cloth as a substitute for Morocco leather, was commenced in the year 1849, in the city of Newark, U. S. The first specimen of it seen in this country, was exhibited in 1851. The Americans have had the merit of producing many labour-saving machines and articles of domestic convenience, and many of them are becoming increasingly known and extensively adopted in this country. It is certain that this article of leather cloth has superseded the use of leather for many purposes to which the old material has hitherto been applied, besides being put to uses for which leather is wholly unsuitable. Messrs. Crockett, the inventors and patentees, commenced the manufacture of leather cloth in England in 1855, and their factory was an old workhouse, situate in one of those dreary, unpicturesque marshes at West Ham, in Essex, a locality somewhat famous for its insalubrious manufactures. The firm was known as the "Crockett International Leather Cloth Company." In 1857 Messrs. Crockett surrendered their business to a company formed under the title of "The Leather Cloth Company Limited," which purchased the entire European business.

The new company, with a paid up capital of £90,000, and having Mr. A. Lorsont as their managing director, began the enterprise with great energy. They erected substantial and extensive premises, which cover ten acres of ground, employing upwards of 200 men. They produce daily 1000 pieces of 12 yards long and 1½ yards wide, or 15,000 square yards; sufficient if laid end to end to reach from their factory to the warehouse in Cannon Street West—a distance of seven miles.

It will be evident that an article intended to resemble leather should be pliant, supple, and not liable to peel off or crack. These excellencies are to be attained by the peculiar ingredients of the composition with which the cloth is covered, and the method of applying it. On entering the factory our attention was first directed to the boiling room, in which there are 12 furnaces, with a large cauldron over each for boiling linseed oil. This process is attended with considerable danger from the liability of the boiling oil to generate gas and explode; hence, a man is stationed at each cauldron stirring gently the boiling mass and watching a thermometer inserted in it, and which at the time of our visit stood at 580°. The oil is supplied to the boiling house by pipes from an adjoining building, where there is a huge tank with nine compartments containing 3,200 gallons each, or 28,800 altogether, amounting to 122 tons of oil. The boiled oil being allowed to cool is conveyed on a tramway to the mixing-house, where, in a puddling machine, it receives several other ingredients, the principal ones being lampblack and turpentine, which being mixed into a composition is ready for use.

The cloth to which this composition is applied is known by the name of "greys," or unbleached cotton. It is of a peculiar manufacture, and made expressly for the company. The store room is a spacious building, and will contain an immense stock; at present it has 25,000 pieces, or 300,000 yards. Here the cloth is calendered, and cut into lengths of twelve yards. The two ends of each length are sewn together to make it endless; two sewing machines are in constant operation at this work. The pieces are then removed to the "milling" rooms, so called because they contain the mills in which the cloth receives the composition. These mills are rough looking wooden structures, having a drum at one end and a roller at the other, over which the cloth is passed, and then tightened by a crank and wheel at one end. A large frame-knife or scraper, is then dropped down close to the cloth, a measured quantity of composition being laid on the cloth along the edge of the knife, the mill revolves, and the cloth receives as much of the composition as can pass under the edge of the knife. The piece is then carried to the heating room adjoining, and hung up on the rack to dry till next morning.

There are on the premises six milling rooms, with three mills in each, and having three men attendant upon each mill. The adjoining rooms for drying are heated by three rows of pipes laid along the wall. These pipes, during the day are at a temperature of about 130°. The temperature is increased towards the evening, and during the night to 160°, and it is the duty of the watchman to open the doors for ventilation and cooling preparatory to the men resuming their work for the next coating.

Of course, in a building so greatly heated, and having so much inflammable material within it, the danger of fire is imminent, but every precaution has been taken which prudence could dictate.

The building is fire proof, the floors are of metallic lava, and the roof, which is flat, is of the same material. A large pipe runs up the outside wall by the partition which divides the drying rooms, into each of which runs a branch pipe with a valve, which can be worked from the outside. A deluge of steam can by these means be poured into the rooms in a few minutes by day or night. There are fourteen fire plugs around the buildings, on the main of the East London Water Works, with hose and turncock at hand, so that ample means of extinguishing fire exist on the premises.

But to return to the manufacture. The coating being thoroughly dry, the cloth is then taken to the "rubbers," whose business it is to remove all inequalities from the surface and make it perfectly smooth. This is done by the "rubbing machine," (an ingenious contrivance of Mr. Eagles, the manager,) by which the cloth is made to pass between two rollers revolving in opposite directions. These rollers are covered with pumice stone, and do the work completely and expeditiously, which, till lately, was done by hand at great expense of labor. The "coating" and the "rubbing" being repeated four, and in the case of heavy goods, five times, the cloth is ready for the "painters." The "painting rooms" contain machines similar to the "mills;" but instead of the drum they have a roller at each end, over which the cloth passes slowly, and a man at each side supplies the paint, "meeting each other half way." Dependant partly on the colours, and partly on the article to be produced, is the number of coats of paint to be applied. Sometimes two will be sufficient, at other times four are necessary. The last coat receives several applications of a peculiar elastic enamel, composed chiefly of copal varnish, to protect it from the action of the atmosphere.

At this stage of the process the edges of the cloth are rough and have to be trimmed, and the seam by which the ends are sown together has to be cut. This is done by a machine called the "Guillotine," and we now follow the cloth to the "grainer." This latter, and to the ordinary leather cloth, finishing process, is done by a remarkably beautiful iron machine, having two, rollers, the upper one being of polished iron cut obliquely on the surface, the other one of paper. Between these two rollers the cloth passes twice, and receives its external resemblance to morocco leather. There are six machines used for this finishing process, and others for embossing from the small diamond to the large mediæval pattern. The latter consumes much more time in passing through the machines. The cloth is now stamped with the trade mark, labelled, and rolled up ready for transmission to the warehouse in Cannon Street West.

On looking at the pieces when finished, one is struck by the extreme cleanness of the inner side after passing through so many soiling operations; this is owing to the practical skill with which the men handle the cloth, and to the agility with which they remove it from the several machines, and carry it to the drying rooms. While watching the process, we thought that in many respects, it was similar to the tanning with sumach, from the leaves and stalks of the *Rhus coriaria*, by means of which skins are made into morocco leather. As the leather cloth can be made permanently soft and elastic by the oily matter combining with the texture of the cloth, as it does with the fibres of the skin, the imitation is complete and successful.

There is another room in this establishment, specially interesting to the artist, where the cloth is printed in gold and colours, in designs which are really chaste and beautiful, and which, when used for the furniture and hangings, adorn rooms with something of oriental splendour. Here, too, there are table-covers with floral borders, rich in colour and choice in grouping, with centre pieces, which, as specimens of decorative art, are very effective. Many of these will be displayed at the International Exhibition, and, we doubt not, will excite both surprise and admiration.

The mixing room is a kind of *sanctum* of the manager's, and we suppose that from the skill with which the colours are prepared arises much of the excellence of the company's manufacture. In a room adjoining there are sixteen colour-grinding mills, constructed on the American principle, and worked by machinery, as in indeed almost everything on the premises seems to be. The machine which sets all in motion is a high-pressure double cylinder engine of 50-horse power made by Woods, of Halifax. There are three immense Cornish boilers by Hill, of Heywood, which have been tested to a water pressure of 130 lbs. to the square inch and represented 60 horse power. One of these is sufficient to work the engine by day and heat the drying rooms by night. We observed that, by the generosity of the company, a part of their premises had been given for the use of the Fifth Essex Rifle Volunteers, the drill room and armoury are magnificent apartments, such as are seldom seen devoted to such a purpose.

A writer in a very useful work on the "Manufactures of Great Britain," asks somewhat triumphantly, "What substitute could be found for leather? a substance at once durable and elastic, affording protection from wet and from cold, capable of being formed into innumerable useful articles, and susceptible of a high degree of ornament, and supplying lining to our carriages and covers to our books." This book was published in 1848, under the direction of the "Committee of general literature and education," and now in 1862, we have a substitute answering all the requirements here specified.

As to protection from wet and cold, the whole American army is equipped with leather cloth in the shape of capes, leggings, and knapsacks, our upholsterers can vouch for its durability and elasticity. The useful articles into which it can be made, and the degree of ornamentation it can receive, are becoming every day more manifest. We line our railway, our street carriages, and our hats with it; and as to our books, if they are not covered with it they ought to be. Truly our progress in art and science is defying all prediction as to what we may not accomplish, and rendering obsolete many of our familiar proverbs, and none more strikingly so than that "there is nothing like leather."—*Mechanics' Magazine.*

L. Perkins, of London, has an engine of 60-horse power, working with a pressure of 500 lbs, on the sq. inch of piston. The consumption of fuel is only from 1 to 1¼ lbs. of coal per horse power per hour.

GOLD IN NOVA SCOTIA.

The whole of the Atlantic shores of the province of Nova Scotia is bordered, in an unbroken line, by strata of a metamorphic character, and probably of great geological antiquity, frequently broken through by eruptive rocks. These form a coast in some places low and rugged, and in others boldly undulating; their soil is generally rocky and sterile, although there are large tracts well covered with timber, and affording prosperous agricultural settlement. Along the Atlantic shore this district is generally low, gradually rising to a height of some hundred feet as it advances northward. Its coast line has, according to Mr. Dawson, a general direction of south 68° west, whilst its inland boundary, although presenting some considerable undulations, has a direction of south 80° west. The extreme breadth of this band at Cape Conseau, its northern extremity, is about eight miles, whilst in its extension westward it gradually increases until, at the west branch of St. Mary's River, eighty miles west of Cape Canseau, it is known to be thirty miles wide. In the western counties, its width has not yet been accurately ascertained, but here its entire breadth cannot be far short of fifty miles. Its total length corresponds with that of the peninsular of Nova Scotia.

This band, in which almost the whole of the gold discovered has been found, chiefly consists of thick bands of slate and quartzite highly inclined, and having a general north-east and south-west strike. In different localities these rocks, which probably belong to the Silurian epoch, have been penetrated by masses of granite, and in their vicinity the quartzites and clay slates usually present a highly metamorphosed appearance.

Since the gold discoveries in California and Australia have been generally known, and public attention has been directed to the conditions under which deposits of the precious metal usually occur, reports of similar discoveries have from time to time locally arisen in different parts of Nova Scotia. In every instance, however, either mica or iron pyrites would appear to have been mistaken for gold. Some years since, also, a considerable amount of excitement was caused by an article in *Blackwood's Magazine*, in which it was affirmed that gold would be found in the hill to the south of Annapolis, and comparisons were instituted between that locality and the Valley of Sacramento. Many persons were induced, by this article, to leave their ordinary occupations to seek for gold, but their researches having in all cases proved unsuccessful, the fever gradually subsided, and the subject was ultimately forgotten. It is also worthy of remark that Dr. Dawson, so long ago as 1855, when describing the great metamorphic band observes:—"Quartz veins occur abundantly in many parts of this district, and it would not be wonderful if some of them should be found to be auriferous."

There is nevertheless no authentic evidence of the discovery of the precious metal in the province previous to 1860, when some hundreds of persons, tempted by rumours of gold having been found, commenced exploring near the head waters of the Tangier River. The amount of gold obtained in this locality was, however, so small, that the miners ultimately became discouraged, and the excitement gradually subsided. In the month of March, last year, a man who was stooping to drink at a brook, observed a piece of gold among the pebbles at the bottom, and having picked it up, searched and found more. This took place about a mile to the east of the Tangier River.

From this date attention became directed to the locality, numerous claims were taken up, and considerable quantities of gold were obtained by breaking the quartz with hammers, and washing the resulting dust in tin pans.

In June, the discovery of gold was reported at Lunenberg, at a locality called the "Ovens." The veins at this place, although generally small, are frequently highly auriferous, and appear to cross each other in almost all directions, in a metamorphic shale belonging to the great southern band. On these discoveries being made known, numerous claims were immediately taken up, and various companies formed for working the veins presenting themselves numerously in the cliff.

Shortly after the discovery of the auriferous nature of the quartz veins, it was found that the sands on the beach beneath the headland also contained large quantities of gold; here claims were likewise rapidly staked off and worked by means of cradles, so that the aggregate daily yeild, from the several shore operations, soon reached one hundred ounces.

Gold discoveries subsequently followed each other in rapid succession, at Lawrence-town, Dartmouth, and Sheet, and Isaac's Harbours, Sherbrooke, and Laidlaw's farm.

The most remarkable deposit of auriferous quartz hitherto found in Nova Scotia is undoubtedly that at Laidlaw's farm. The principal workings are here situated near the summit of a hill composed of hard metamorphic shales, where openings have been made to the depth of some four or five feet upon a nearly horizontal bed of corrugated quartz of from eight to ten inches in thickness. This auriferous deposit is entirely different from anything I had before seen, and when laid open presents the appearance of trees or logs of wood laid together side by side after the manner of an American corduroy road.

From this circumstance the miners have applied the name of "barrel quartz" to the formation, which, in many cases, presents an appearance not unlike a series of small casks laid together side by side and end to end.

The diagram on the wall will serve to explain the mode of occurrence of this deposit.

The rock covering this remarkable horizontal vein is exceedingly hard, but beneath it for some little distance it is softer and somewhat more fissile. The quartz is itself foliated parallel to the lines of curvature, and exhibits a tendency to break in accordance with these striæ.

The headings and particularly the upper surfaces of the corrugations, are generally covered by a thin barklike coating of brown oxide of iron, which is seen frequently to enclose numerous particles of coarse gold, and the quartz in the vicinity of this oxide of iron is itself often highly auriferous.

The other gold veins of the province present generally speaking, few distinctive peculiarities, and very closely resemble those found in California and Australia. Their general course is north 60°

west, and their dip towards the south, but there are not unfrequent exceptions to this rule.

In addition to gold, the most auriferous veins of Nova Scotia contain variable quantities of iron-pyrites, mispickel, galena, blende, and less frequently a small proportion of argentiferous and auriferous sulphide of copper. Here, as elsewhere, the presence of the sulphides is regarded as a favourable indication of the richness of a vein, and leads containing much disseminated galena almost invariably yeild a remunerative quantity of gold.

The productive veins hitherto discovered have, as before stated, been found in the older rocks on the Atlantic shore, and commonly occur in parallel groups, near the centre of which, and parallel to the productive veins, a large reef of crystallized and comparatively unproductive quartz is in many instances found to run. These large courses are locally called "bull veins," and usually contain small quantities only of the precious metal.

The attention of the Nova Scotian goldminers, has, contrary to the usual practice, been almost entirely directed to the exploration of the veins of gold quartz, and alluvial digging has consequently been all but entirely neglected. There, is however, every reason to believe that a careful examination of the alluvial deposits would lead to the discovery of large quanties of gold.

It would be impossible to form any reliable estimate of the total amount of gold which has hitherto resulted from mining operations in Nova Scotia, as the claims are for most part worked by private individuals who are generally indisposed to furnish information either as to their success or failure, and no official returns on the subject have as yet appeared. It is manifest, however, from the characteristics of the localities in which the precious metal has already been discovered, and the great extent of the gold-bearing portions of the province, that there is every reason to anticipate that further and more important results will be developed by the workings and explorations of the present summer, and that, ere long, Nova Scotia will take an important position among gold-producing countries.

The thickness of its auriferous veins is perhaps less than those of California and some other countries, but they are, generally speaking, richer in visible gold than the average of those I have seen in any other part of the world. It must also be taken into consideration that Nova Scotia possesses many decided advantages over both California and Australia. Each of these countries is situated at a great distance from Europe, and can only be reached after a long and expensive passage, and, as a natural consequence, wages were for a long time exceedingly high and provisions proportionately dear. Nova Scotia, on the contrary, is within an easy distance both from Europe and the United States of America, and possesses a considerable settled population of intelligent, industrious, and sober people, eminently adapted, after a little experience, to become steady and efficient miners. The whole of the gold-bearing portion of the Province also lies within a convenient distance from the coast, which abounds with magnificent harbours, affording ample security to shipping, whilst wood in large quantities is to be everywhere procured for all descriptions of mining uses, and an abundant supply of water is generally to be met with for the purposes of washing and amalgamation.

From these circumstances, it is impossible that wages can ever reach the extravagant rates that mainly led to the failure of nearly all the gold-mining enterprises of 1852, since which period many of the mines have been advantageously worked which were then abandoned on account of the enormous expenditure necessary to carry on the operations.

On the Filtration of Air, and the Influence which it Exerts on Fermentation, Putrefaction, and Crystalization, by M. H. SCHROEDER.

This paper is in continuation of some researches published some time ago by the same author. M. Schroeder found that the ebullition of a fermentescible or putrescible liquid, in a flask closed with a plug of cotton, generally checked fermentation. However, milk, yolk of egg, and broth containing meat, gave him different results.

On repeating these experiments he found that, in order to prevent, by means of a plug of cotton, the putrefaction of the above-named substances, they ought to be previously raised to a temperature higher than that of boiling water. If this precaution were taken, and if the substances were then introduced into a flask, and the liquid boiled during a very short time, the flask being then closed with cotton wool before the temperature lowered no change would be produced.

The same result is obtained by very considerably prolonging the ebullition.

When the liquid is only boiled for a short time, the formation of *mycodermes*, which are produced in the open air, is not noticed on its surface. Fermentation, however, takes place, and it may, therefore, be concluded that the ferment capable of inducing putrefaction is contained in the state of germ, in milk, meat-broth, and yolk of egg, and is not destroyed at a temperature of 100° C.

The author has attempted to transport the ferment which provokes putrefaction into different liquids. He performed this operation with very great precaution under a bell-jar filled with coal gas. He found that this particular ferment was not developed in liquids susceptible of nourishing the ordinary vegetable ferments, such as beer-yeast but that it was propagated, on the other hand, in the presence of albumen, casein, yolk of egg, and urine, and induced the putrefaction of these liquids even when they had been previously heated to temperatures much exceeding 100° C.

After having quoted a certain number of experiments performed on supersaturated saline solutions, M. Schroeder finishes by stating a certain number of conclusions, of which these are the principal:—

There exists a series of phenomena of fermentation and putrefaction which are due to germs existing in the atmosphere; such are the alcoholic and lastic fermentations, mouldiness, and the putrefaction of urine

Animal or vegetable substances contained in a flask closed by a plug of cotton are protected against all fermentation, when the germs which they contained have been destroyed by ebullition.

All germs carried in the air are destroyed by a short ebullition. However, milk, yolk of egg, and

meat contain germs which are only destroyed by a prolonged ebullition, or by a temperature higher than 100° C.

The germs contained in these latter substances are susceptible, even after an ebullition which has not been long continued, of inducing putrefaction, by developing and taking the form of *vibrios*, large in size, but sluggish.

This putrefactive ferment is of animal character. It lives at the expense of albuminoid matters, and cannot multiply under conditions which are favorable to the developement of vegetable ferments.

The crystalization of supersaturated solutions is provoked by a kind of induction exerted by the surfaces of solid bodies.

The crystalization of more soluble hydrated bodies is due to a less energetic induction than that which provokes the deposition of less soluble hydrated bodies.

The strongest induction is exercised by the surfaces of crystals of the same nature as the dissolved salt. The inductive force of the films of air formed on the surfaces of solid bodies is less. These films are destroyed by heat or by prolonged immersion, and only re-form very slowly in filtered air.

The crystalization of more soluble hydrated bodies is only induced very slowly by a crystal of the same body introduced into the liquid with all the necessary precautions; whilst the presence of a crystal of a less soluble hydrated body induces an immediate crystalization of the solution.

Supersaturated solutions isolated from the outer air, whilst still warm, by a plug of cotton are preserved a very long time, because the cotton prevents the access of all the solid particles floating in the air. Simple shaking is without action on supersaturated solutions, at least if it does not bring them into contact with certain parts of the flask, which already possess an inducing power.—*Annalen der Chemie und Pharmacie*, cix. 35.

THE EARL OF DERBY ON NOXIOUS VAPOURS.

The Earl of Derby, in moving for the appointment (Friday, May 9th) of a Select Committee to inquire into the injury resulting from noxious vapours evolved from certain manufacturing processes, and into the state of the law relating thereto, said, in the absence of any more exciting topics of discussion, he hoped he might be excused for bringing before their Lordships, as shortly as he could, a subject certainly so far removed from the range of party, or what was commonly called politics, that his only fear was that he should not be able to attract their Lordships' attention to it in a degree commensurate with the real importance of the question. Some time back their Lordships had conferred a great advantage upon the metropolis by passing a stringent measure against what was called the Smoke Nuisance. Their Lordships had also introduced a stringent measure with regard to polluting rivers so as to effect the produce of salmon. But this could not be placed in competition with matters which effect health, or the productive power of land. With regard to the poisoning of the air, and the streams and rivers of the country, the noble Earl stated he had been informed by Dr. Lyon Playfair—than whom no more eminent name need be mentioned—that, on being called on to investigate a case where the water was alleged to have been poisoned by the refuse which had been turned into it from a manufactory where arsenic and lead were largely employed, he had found that though the water did not contain a sufficient quantity of poison to be injurious to health, yet, upon an analysis of one pound of mud, there were from ten to twelve grains of arsenic. The noble Earl next referred to the increase of alkali works, such as alum, soda, potash, and pearlash, and remarked how largely they entered into various manufactures. In Newcastle-upon-Tyne there is one of these manufactories which employs not less than 1000 persons, and covers under one roof sixteen acres of land. Those of their Lordships who had travelled by the London and Northwestern Railway probably recollected near Warrington a most beautiful specimen of brickwork, in the shape of a column 131 yards in height. It was erected by Mr. Muspratt in order to meet the complaint that was made of the injury caused by his works. However, the great height of the tower only had the effect of carrying the vapours further off. The manufacture of soda was carried on by the decomposition of common salt, by means of sulphuric acid; and in most establishments the manufacture of sulphuric acid was also carried on. That was produced by the combustion of nitre and sulphur, and resulted in the most offensive and most noxious vapours. Fortunately, however, it happened that it was the interest of the manufacturers to condense the whole of those vapours, and most of the works in which both soda and sulphuric acid were manufactured, caused no inconvenience in the neighbourhood. Unfortunately, it was not sufficiently the interest of manufacturers to condense the muriatic acid gas caused by the manufactuıe of soda. The works of Mr. Muspratt were begun in 1831 or 1832. For some years there were great complaints in the neighbourhood of the injury done to crops, fences, and trees; and at last the evil became intolerable. In 1846, the late Mr. Lee, the proprietor of a large proportion of the land in the neighbourhood, obtained a considerable amount of damages from Mr. Muspratt, and another gentleman obtained no less than £1300. damages. The manufacture was nevertheless continued; but in 1851, Mr. Lee, finding that the timber on his estste was either killed or greatly damaged, brought fresh actions against Mr. Muspratt, which were compromised by the latter paying £2000. and costs, and giving a promise, which was punctually performed, to pull down and destroy the whole of his works. There then sprung up at St. Helen's a considerable number of other works, against which, in the same manner, the neighbouring proprietors were compelled to bring their actions. In 1839, Sir John Gerard recovered £1000. damages; in 1846, £2000.; and in 1852, he brought an action for more than £4000., which was suspended by reason of his dangerous illness and subsequent death. In the meantime, additional manufactories had sprung up, and the difficulty of tracing injury home to any particular person was proportionately increased. The consequence of these manufactures was that for four or five miles round St. Helen's, in the direction in which the wind usually blew, there was scarcely a living tree. (Hear.) The landed property had deteriorated to the extent of £200,000. His (the Earl of Derby's) house was five or six

miles from St. Helen's, and on the side of his park next that town there had of late been a very considerable decay in the older timber, and to a certain extent he attributed it to the poisonous fumes of the manufactures in question. Now, so far as most of such manufactures were concerned, a perfect remedy might be applied, as the vapours might be condensed in the simplest possible manner. Water would absorb 480 times its own bulk of muriatic acid gas, and consequently a constant flow of water down the chimney would absorb the gas as it rose. Some of the manufacturers already took this precaution, but very many neglected to do so, and in many cases where the precaution was taken the water was allowed to run into brooks, which thereby became poisoned. The water, however, might not only be rendered innocuous, but might be turned into a scurce of absolute profit. The present law did not afford a sufficient remedy. For the purposes of prevention, the law of England was absolutely silent, except as to very partial provision made by the Public Health Act, which gave a certain power of preventing the erection of nuisances such as he had referred to. There were, therefore, only two courses open—one to individuals, and the other to the public — for remedying the great injury done by these works, viz., an indictment for a nuisance, and an action for damages. In bringing an action for damages one should prove the injury, and the extent of the injury, and also that it was done by the specific work; and although some persons might succeed in getting large damages, still they did not succeed in putting down the nuisance. The noble Earl concluded by saying it was not intended to restrict the operations of trade; the aim of his motion was to inquire how far legislation might be introduced which, without injury to manufactures, might protect the community against the noxious vapours arising from them. (Cheers.) After some discussion the motion, as originally framed, was agreed to.

THE DISCOVERIES OF 1861.*

At the close of each year for several years, David A. Wells, A.M., has published a volume containing an account of all the important discoveries in science and art made during the year. The periodicals of England, the continent of Europe, as well as of this country, are carefully watched, and the mention of every new discovery is extracted. The book usually contains about 400 pages, and a copious index renders it a most convenient work for reference.

Crystalline Structure of Iron induced by Vibration.

The spontaneous change forged and rolled iron undergoes when submitted to continuous vibration is productive of so much critical danger, especially in the case of railway machinery, that an investigation into the best means of remedying the resulting evils has been viewed as an engineering question of vital importance. Among others, Mr. Schimmelbuch, of Liege, has undertaken the subject, and the following is an epitome of his investigations: A bar of pure unalloyed iron was struck by a hammer three times in a minute for six consecutive weeks; at the expiration of this time it broke into three pieces. Before the experiment the bar was a good specimen of fibrous iron; after, on the contrary, its fracture exhibited a brilliant crystallized structure, resembling that of antimony.

A bar of iron alloyed with nickle, submitted to the same treatment, underwent no change.

A very simple means exists of recognizing this changed condition of iron, so dangerous in its consequences. Pure iron, when magnetised by contact, loses its magnetic properties immediately the needle is detached. On the other hand, iron combined with minute quantities of some foreign body, such as carbon, oxygen, sulphur or phosphorus, remains magnetised. The efficacy of this simple test has been established by repeated experiments.—*London Photographic News.*

Under the patronage of the Austrian government M. Bourville has also recently instituted a course of experiments with a view of throwing some additional light on the subject of the induction of a crystalline structure in wrought iron through vibrations.

M. Bourville's apparatus consisted of a bent axle, which was firmly fixed up to the elbow in timber, and which was subjected to torsion by means of a cog-wheel connected with the end of the horizontal part. At each turn the angle of torsion was twenty-four degrees. A shock was produced each time that the bar left one-tenth to be raised by the next. Seven axles were submitted to the trial. In the first the movement lasted one hour, 10,800 revolutions, and 34,400 shocks being produced; the axle, two and six-tenths inches in diameter, was taken from the machine and broken by a hydraulic press, and no change in the texture of the iron was visible. In the second, a new axle, having been tried for hours, sustained 129,000 torsions, and was afterward broken by means of a hydraulic press; no alteration of the iron could be discovered by the naked eye on the surface of rupture, but, tried with a microscope, the fibres appeared without adhesion, like a bundle of needles.

A third axle was subjected, during twelve hours to 338,000 torsions, and broken in two; a change in its texture, and an increased size in the grain of the iron were observed by the naked eye. In the fourth, after one hundred and twenty hours, and 2,588,000 torsions, the axle was broken in many places; a considerable change in its texture was apparent, which was more striking towards the centre, and the size of the grains diminished toward the extremities. In the fifth, an axle was submitted to 23,328,000 torsions, during seven hundred and twenty hours, was completely changed in its texture; the fracture in the middle was crystalline, but not very scaly. In the sixth, after ten months, during which the axle was submitted to 78,732,000 torsions and shocks, fracture produced by a hydraulic press showed clearly an absolute transformation of the structure of the iron; the surface of rupture was scaly, like pewter. In the seventh and final case, an axle submitted to 128,304,000 torsions presented a surface of rupture like that in the preceding experiment; the crystals were found to be perfectly well defined, the iron having lost every appearance of wrought iron.

* (Scientific American.)

New kind of Electric Current.

When pure water flows through a porous body, an electrical current is elicited; a fact established by experiments, says M. G. Quincke, which may be stated concisely in these terms:—

Some thirty layers of thin silk stuff were placed over each other and attached over one tube of the apparatus; another tube was then adapted against the former; and the part separating them covered thickly with sealing-wax. Owing to the wide pores of the silk, considerably more water flowed through, under equal pressure, than when the clay plate was employed. The linen was used in the same manner.

The other substances were applied in the form of powder, in a glass tube of the diameter of the above tubes. The ends of these tubes, the length of which varied, according to the substance employed, from twenty to forty-five millims., were ground flat, and over them were placed disks of the silk stuff spoken of, to prevent the flow of the fluid carrying away particles of the substance under examination. In the case of Bunsen's coil, the tube was closed with plates thereof.

Platina was made use of in the spongy form, iron as filings. The glass had been reduced to powder on an anvil. Ivory and the various kinds of wood were employed in the form of sawdust. It was endeavored in vain to press water through a porous plate of wood, for the plate had to be luted in dry; and on becoming moist, even if cut perpendicular to the direction of the fibres, it warped so much that it broke the sealing wax or the tube.

The direction of the electric current was not changed by adding acids or solutions of salts to the distilled water, but it was considerably weakened thereby.—*Poggendorff's Ann.*

Electricity Generated by Evaporation.

Mr. Palmiere, in a note in the *Cosmos* (Paris), states that in order to obtain electricity by condensing vapors, he had some water in a capsule of platina, not insulated, made to boil slowly. He collected the vapor upon a platinum refrigerator, at a height of about two feet above the surface of the water, and by means of a condensing electroscope soon convinced himself that the vapor manifested positive electricity. Encouraged by this result, he sought to discover the negative electricity in the capsule of platinum which contained the water in a state of vaporization. Having isolated the capsule, and put it in connection with a condensing electroscope, he concentrated the solar rays on the distilled water in the capsule by means of a lens about a foot in diameter. He thus obtained a superficial ebullition, hardly visible, and also indications of negative electricity in the capsule. He afterward varied the mode of experimenting, and operated on different liquids.

What is Heat Lightning?

The flashes of lightning often observed on a summer evening, unaccompanied by thunder, and popularly known as "heat lightning," are merely the light from discharges of electricity from a thunder-cloud beneath the horizon of the observer, reflected from clouds, or perhaps from the air itself, as in the case of twilight. Mr. Brooks, one of the directors of the telegraph line between Pittsburgh and Philadelphia, informs us that, on one occasion, to satisfy himself on this point, he asked for information from a distant operator during the appearance of flashes of this kind in the distant horizon, and learned that they proceeded from a thunder-storm then raging two hundred and fifty miles eastward of his place of observation.—*Prof. Henry.*

Magnetic Phenomena.

M. Ruhmkorff has the following notice in the *Comptes-Rendus*, vol. 1, p. 166:—"If a stay (bride) of soft iron be pressed against one of the poles of an artificial magnet, the soft iron is observed to become hard, and it is more difficult to file. If the stay be removed, it loses its hardness and resumes all the properties of soft iron."

Miscellaneous.

Air Power with combustion of Gas.*

This power of a new description, has been invented in Paris, two years ago, by Mr. E. Lenoir. Here is the principle on which it acts. If in an air tight receiver, a mixture of combustible gas and air be introduced and inflamed, the gas will burn, generally with explosion, and produce a considerable elevation of temperature. The gas mixture, suddenly heated, will tend to expand, pressing with a heavy weight on the sides of the receiver.

Mr. Lenoir attempted to benefit the manufacturing community with this new expansion of the air by heat. His power has very much the same external appearance as steam power, with the exception of the boiler and furnace, which are dispensed with. It consists of a strong cast iron cylinder, with a corresponding piston and rod attached to the axle of a fly wheel, along with the claps put in motion by excentrics. On each side of the cylinder is a clap, connecting on the one side the cylinder with the gas receiver, and on the other the receiver with the outside, allowing the issue of the air after having performed its work by expansion on the piston.

In order to illustrate the action of the whole machine let us suppose the piston ready to give a full stroke. The gas clap will be then opened, and the piston in moving will introduce the gas along with the air, by openings made in the clap, so that air is supposed to be in the piston in alternate layers with the gas. This arrangement makes its combustion less explosive, meantime the power is increased. When the piston will have advanced one-third of the stroke, the clap shuts, and through an electric spark the mixture is inflamed. The air expanding with a power equal to the high temperature thus produced, will drive the piston at a full stroke, when an outlet is procured to the expanded air, through the particular clap. The fly wheel will keep up the motion and the piston will return, introducing a fresh supply of gas and air, which will be inflamed when the third of the stroke will be performed, and so on at each extremity of the cylinder alternately. As this combustion of gas, kept on for some time, might increase the temperature of the cylinder to a high figure, a double

* *From the "Lower Canada Agriculturist."*

cylinder is used as a covering to the first, leaving a certain distance between the two, so as to allow a constant run of fresh water.

These powers are now extensively used in Paris. A single horse power will give twelve hours work at $1 50. The advantage is in the facility afforded to use the city gas, without the annoyance and expense of a particular man to drive it. By turning the gas the machine is at once ready to work, and it can be stopped with the same facility. There is no danger from either fire or explosion. One of these machines, ½ horse power, has been imported as a model by Mr. E. H. Parent, civil engineer, Quebec, who will receive and answer all communications on the subject, with all dispatch, and due attention.

Uniform Weights and Measures.

Under the auspices of the International Association for obtaining a Uniform Decimal System of Measures, Weights, and Coins, a collection of the weights of the various countries of the world has been made, and these will form part of the curiosities of the International Exhibition. Few persons are aware of the extraordinary diversities in weights and measures which exist in our own country. The price of corn, for instance, will be quoted in at least fifteen different ways, in as many different localities; at so much per cwt., per barrel, per quarter, per bushel, per load, per weight, per bole, per bag, per coomb, per hobbet, per winch, per windle, per measure, per strike, per stone. The word bushel is in some places used for a measure, in others for a weight, and this weight is by no means the same in all places. In different towns of England the bushel means 168 lbs., 73½ lbs., 62 lbs., 80 lbs., 75 lbs., 72 lbs., 70 lbs., 65 lbs., 64 lbs., 63 lbs., 5 quarters, 144 quarts, 488 lbs.; and in Manchester, while a bushel of wheat is 60 lbs., a bushel of American wheat is 70 lbs. The measuring of a stone is almost equally various. An acre of land expresses seven different quantities. These variations are highly inconvenient and prejudicial to the transactions of trade; and the labours of the above-named association are directed to the bringing about a uniformity, of which there is great need. The metrical system employed in France is that which is advocated. This has been already established in Belgium, Holland, Sardinia, Lombardy, Greece, Spain, Portugal, and many other parts of the world. Great Britain and the American States, however, still adhere to their old systems.

It may be trusted that our legislation will, ere long, look this matter boldly in the face, and at a single stroke abolish the inconveniences, absurdities, and annoyances contingent upon the anomalous state of things which at present obtains. The decimalization of weights, measures, and money, is a thing which would immortalize the names of any government accomplishing it, and confer on the British public a boon which they would know how to appreciate.—*Mechanics' Magazine.*

The Prevention of Boiler Explosions.

A correspondent writes to the *Manchester Guardian:*—"The dreadful calamity near Bilston, entailing the violent death of twenty-eight persons, has induced me to trouble you with a few observations on boiler explosions. These so-called accidents arise in the great majority of cases simply from the circumstance that, from original faulty construction or subsequent wear, the material is unable to withstand the requisite pressure. Since the lamentable catastrophe at Mr. Sharp's works, I have uniformly maintained that explosions are always the result of culpable ignorance or negligence—ignorance of the use and necessity of a proper hydraulic test, or neglect of it if known. I am aware that some have pretended that the hydraulic test is injurious to the boiler, and hastens the subsequent explosion. There is no foundation for this opinion. On the contrary, it is certain that if a material, say an iron-wire, has supported a weight for a short time, it may be relied on to support a weight a trifle lighter for a long time afterwards. Besides, I would ask why a test should be refused in the case of steam boilers, when it is applied, as a matter of course, to rifles, cannon, chain-cables, &c. I long ago pointed out, in your columns and elsewhere, a method of testing boilers by hydraulic pressure, in which the conditions of strain under actual work were approximately fulfilled. This method involves scarcely any trouble, and no expense, consisting simply in the use of the expansion of water by heat. Had a pressure one-third greater than the working pressure been so applied from time to time to the Bilston boiler, its weakness would have been long ago exposed, and the loss of life would have been prevented. In suggesting the above test, I was not influenced by merely theoretical considerations. I had repeatedly tested the boiler of a small steam engine employed for scientific researches at Whalley Range. I would ere now have been in the possession of ample details on this subject, so important to humanity, had I not at my present residence met with an unexpected and certainly most uncalled-for opposition to my experiments. However, though unable to show the application of the test to my own boiler, I shall have great pleasure in assisting anyone who may wish to make use of it."

Improved Lucifer Matches.

We have recently had occasion to notice some of the many patented improvements which have of late been introduced into the manufacture of lucifer matches. One of the most novel and important inventions under this head is the "patent special safety match" of Messrs. Bryant and May, of Fairfield Works, Bow. The protection afforded by the use of this match is based upon the circumstance that it will only ignite by being rubbed upon the prepared surface of the box; no ordinary kind of friction being capable of inflaming the combustible materials with which the wooden splints are tipped. The match does not itself contain any phosphorus, but is coated merely with oxydising substances, such as chlorate of potash in conjunction with binoxide of lead or manganese, and the ingredients are in this manner so divided that it is necessary to employ the special friction surface, prepared with amorphous phosphorus, in order to secure the inflammation of the match The security against accidental conflagration is thereby reduced to a minimum; the splints have, indeed, so little of the dangerous character of the ordinary match that the makers announce that their manu-

facture enjoys the exclusive privilege of being sanctioned and admitted within the building of the International Exhibition. The matches were at first coated with sulphur in the usual manner; but this practice appears to have been discarded almost immediately in favour of the employment of some kind of fatty matter for impregnating the wood. No phosphorus being employed in the match composition, they are, of course, quite destitute of the unpleasant odour and poisonous character of this substance. The dangerous practice of carrying loose matches about the house, and the common habit among servants of striking them upon the wall to the disfigurement of the paper-hangings, will be altogether avoided by the introduction of Bryant and May's patent special safety match.—*Chemical News.*

Machinery For Printing Calicoes.

An idea may be formed of the extraordinary influence which the introduction of machinery and improvements in engraving have had in cheapening the cost of printed calicoes, from the statement made by Prof. Calvert of the United States, that large furniture patterns, such as are required for some of the oriental markets, and into which sixteen colours and shades enter, would have cost formerly from 7 dols. to 9 dols. per piece, because they would have required sixteen distinct applications of as many different blocks, and would have required more than a week in printing, whereas the same piece can now be printed in a single operation, which takes three minutes, and costs about 1 dol. 50-

The Electric Light.

M. Nadar has recently succeeded in obtaining a series of singular and interesting views of the Catacombs of Paris, by illumining them with the electric light. The French department of the International Exhibition possesses some photographs printed by the aid of this light. Plants, grown under the influence of the electric light alone, are said to assume their green tint as in sunlight.

Interesting Geological Discovery at Hastings.

The fall of the cliff near Hastings has brought to light an interesting slab of stone bearing on its surface the clear impression of the foot of a gigantic bird. It has three toes, each of which is about nine inches long in the tread, with a claw at the end, of perhaps two inches in length. The back of the foot, where the three toes meet as in a centre, does not appear; that part of the foot did not reach the ground. But still further back is the mark made by the point of the spur, or fourth toe. From the point of the middle claw to the mark of the spur it measures twenty-four inches, and in width twenty inches. The whole of the slab is covered with the lines of ripple made by the waves upon soft mud, and there are numerous other impressions more or less perfect of the same bird's claws on other slabs of stone. The bird which has left us this footprint may be supposed to have been at least twelve feet high, and perhaps much more. Mr. Jones, of the Geological Society, Somerset House, suggests that it may not be the footmark of a bird, but probably of the iguanodon. But he has not seen the original slab.—*West Sussex Gazette.*

The Iron Fleet of Britain.

In addition to the iron frigate Achilles, 50, 6,079 tons, 1,250 horse power, building at Chatham dockyard, the following squadron of iron vessels are now under construction by private firms for the Admiralty, several of which are in a very advanced state—viz., the Agincourt, 50, 6,621 tons, 1,250-horse power, building at Birkenhead; the Northumberland, 50, 6,621 tons, 1,250-horse power, and the Valient, 32, 4,063 tons, 800-horse power, building at Milwall; the Minotaur, 50, 6,621 tons, 1,250-horse power, and the Orontes, 3, 2,812 tons, 500-horse power, building at Blackwall; and the Hector, 32, 4,063 tons, 800-horse power, building at Glasgow. The following iron-plated frigates are now building at the several Royal dockyards, the whole of which are intended to be afloat during the present year—viz., the Caledonia, 50, 4,045 tons, 800-horse power, at Woolwich; the Ocean, 50,4,045 tons, 1,000-horse power, at Devonport; the Prince Consort, 50, 4,045 tons, 1,000-horse power, at Pembroke; the Royal Oak, 50, 3,716 tons, 1000-horse power, at Chatham; and the Royal Alfred, 50,3,716 tons, 800-horse power, at Portsmouth. In addition to the above there are no fewer than 31 line of-battle ships and other screw steamers now on the stocks at the several dockyards, most of which are admirably adapted for conversion into shield ships, on Captain Coles's principle. Of these the Bulwark, 91, at Chatham; the Repulse, 91, at Woolwich; the Robust, 91, at Devonport; and the Zealous, 91, at Pembroke, are all in a very advanced state, requiring only a comparatively small outlay to plate them with iron. There are also three first-class 51-gun frigates also building—viz., the Belvidera at Chatham, the Tweed at Pembroke, and the Dryad at Portsmouth,—which are admirably adapted for conversion into armour-plated ships. They would not require the removal of any decks, as would be the case with line-of-battle ships, but would only have to be lengthened and strengthened to enable them to bear the increased weight which would be placed on them. Of the other vessels in progress several are intended to carry 22 guns and upwards. If completed as iron-cased steamers they would be larger and of greater tonnage than either the Monitor or Merrimac. The whole of the hands have been removed from the wooden ships building at the several dockyards, and are now employed on the iron-cased frigates under construction, five of which will be afloat by the end of the present year.—*Times.*

Canadian Copper.

The quantity of ore produced at the Bruce Mines during the past season was 472 tons 11 cwt. 3 qrs. 2 lbs., of 17 per cent., being about 75 tons short of the previous year's production. The production at the Wellington Mine (leased from the Montreal Company by the West Canada Mining Company) was 1,175 tons, of about 19 per cent., being over 100 tons short of the previous year's production. The royalty paid to the Montreal Company from the Wellington was about 58 tons. The quantity produced at the Huron Copper Bay Mine, also in the hands of the West Canada Company, will, it is believed, exceed that of the Wellington, and probably bring last year's produce of the Bruce and Wellington and of the Huron Bay together to about 3,000

tons, a substantial proof of the capability of the district. The value of the ore approaches $250,000 a considerable addition to the exports of the country from one small port, but a mere trifle of what might be done did the Government provide efficient steam communication with the upper lakes.—*Report of the Lake Huron Mining Co.*

Consumption of Timber in England.

Upwards of three million loads of timber and wood were imported into this country, and entered for home use, in 1861; a quantity less by 166,624 loads than in 1860. The computed real value of the entire imports of timber and wood, for the year 1861, fell short of ten millions sterling by seventy thousand pounds only.

Test for Gaseous Sulpurous Acid.

Hugo Schiff employs paper moistened with solution of protonitrate of mercury which instantly assumes a gray colour from reduced mercury; it is requisite to test with lead paper for sulphuretted hydrogen. Both gases are not present at the same time, as they decompose each other.—*Dingler's Journal.*

The British Museum.

The correspondence between the Treasury and the trustees of the British Museum on the subject of providing additional accommodation for the varied collection belonging to the great national establishment has been published. From this it would appear that the trustees are resolved to separate the plethoric contents of the present museum by removing the departments of natural history, including those of geology, mineralogy zoology, and ethnography, to a new building to be erected on the estate of the exhibition of 1851. By the removal of these collections from the museum an area of some 65,000 feet will be left vacant, and this may be appropriated chiefly to exhibition rooms for coins, medals, prints, engravings, &c., &c., and more space for the library, which grows larger at the rate of 30,000 volumes annually. It is understood that the Treasury regards this proposition with favour, and that it is probable a Bill will be introduced to Parliament embodying it.

Revivification of Animal Charcoal.

MM. Leblay and Cuisinier give (*Comptes-Rendus*, t. liv. p. 270) a new process for reviving exhausted animal charcoal. They find that the power of absorbing coloring matter is restored on treating the charcoal with weak boiling solution of caustic alkalies. They also say that the original absorbing power of the charcoal may be very much increased by pouring over it a weak solution of biphosphate of lime.

Chloride of Lime as an Insecticide.

In scattering chloride of lime on a plank in a stable, all kinds of flies, but more especially biting flies, were quickly got rid of. Sprinkling beds of vegetable with even a weak solution of this salt effectually preserves them from the attacks of caterpillars, butterflies, mordella, slugs, &c. It has the same effect when sprinkled on the foliage of fruit trees. A paste of one part of powdered chloride of lime and one half part of some fatty matter, placed in a narrow band round the trunk of the tree, prevents insects from creeping up it. It has even been noticed that rats and mice quit places in which a certain quantity of chloride of lime has been spread. This salt, dried and finely powdered, can, no doubt, be employed for the same purposes as flour of sulphur, and be spread by the same means. — *Dingler's Polytechnisches Journal*, clxi. 240.

Horticultural Curiosity.

"At the present moment," says the *Independance Belge*, "may be seen in a garden at Fexhe-le-Haut-Clocher, Belgium, a fine cherry tree not in blossom, but bearing good-sized cherries. It is true that the tree has been covered every night with matting, and has been for some weeks passed watered with lukewarm greasy water. This is a remarkable instance of precocious vegetation."

To Check the Warping of Planks.

The face of the planks should be cut in the direction which lay from east to west as the tree stood. If this be done, the planks will warp much less than in the opposite direction. The strongest side of a piece of timber is that which in its natural position faced the north.

Coal Tar to Prevent the Potato Disease.

M. Lemaire mixed two per cent. of coal tar with earth, scattered the mixture over his ground, dug it in eight inches deep, and then planted his potatoes. None of those protected by tar showed any sign of the disease, while more than half of some planted at a short distance on the same day, and left unprotected, were found to be diseased.

A New Lathe.

A new lathe has been recently patented by Messrs. W. Muir & Co., of the Britannia Works, Strangeways. By an ingenious adaptation of two treadles, with alternate action, as much power is obtained for turning metals as with steam power of the same capacity. We believe that this is an entirely new feat in mechanics,—to obtain, without steam, as great a result, in cases in which power is required, as is accomplished by steam. Such a lathe will be of incalculable service on board vessels, and in those colonies—such as India—where labour is cheap. The lathe will be shown at the International Exhibition.—*Manchester Guardian.*

Sex of Eggs.

M. Genin lately addressed the Academie des Sciences on the subject of "The Sex of Eggs." He affirms that he is now able, after having studied the subject for upwards of three years, to state with assurance that all eggs containing the germ of males have wrinkles on their smaller ends, while female eggs are smooth at the extremities.

To clean Marble.

Mix pumice-stone, very finely powdered, into a paste with verjuice; let it stand for two hours; with a sponge then rub it over the marble, and allow it to dry on; then wash it off with clean water, and dry it with soft linen.—*Builder.*

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

JULY, 1862.

HOME MANUFACTURES, vs. IMPORTED ARTICLES.

One of the advantages of our annual Provincial Exhibitions, consists in placing before the public eye, where they may meet with the greatest share of attention, those articles of general consumption which might be largely manufactured in the Province, if due encouragement were given to home industry in all its branches. We imported, for instance, in 1861, 321,084 lbs. of starch, yet the raw material from which starch is manufactured,—namely, grain,—chiefly wheat and Indian corn,—together with potatoes, are staple productions. Of china, earthenware and crockery, we imported to the value of $274,369. This branch of industry is altogether in its infancy in the Province, and is one which offers an ample field for enterprise. At the last Provincial Exhibition, there were some good specimens of native art in the coarser varieties of crockery, which will no doubt be much improved on at our next exhibition. Of glass and glass-ware, we have hitherto had no representation; and this industry is not even referred to in the prize list; yet last year we imported to the value of $344,527. Sandstone for glassmaking exists at Williamstown, Beauharnois, and was used for the manufacture of glass some years ago at St. John's and Vaudreuil, but it was found difficult to compete with foreign importation. The rock from which this excellent sandstone is obtained is called geologically the Potsdam Sandstone. We may yet look for the introduction of glass-making in Canada. The raw materials are present in abundance, and it is a mere question of time as to the extensive manufacture of all common articles of glassware as soon as a beginning is once made and public attention directed to the subject. Of the different varieties of candles, we imported to the amount of $36,227; and yet we now possess within our own resources, much material for the manufacture of common wax, and paraffine candles. Our consumption of tallow is enormous; in 1861, the total importation amounted to no less than 3,045,122 lbs., valued at $242,474. It is clear that the demand for the raw material is far beyond the resources of the country to supply, and as it enters the Province free of duty, we may assume that it is consumed chiefly in the manufacture of candles, on which there is an *ad valorem* duty of 20 per cent. The Petroleum refineries should now supply as much of the crude material as we require for the manufacture of paraffine candles, which are superior to wax; and thus a new branch of industry may shortly spring up in our midst. Salt belongs to the class of free goods; it is an absolute necessity of life, and last year we consumed 1,697,314 bushels, valued at more than $300,000. Salt is one of those articles which form a very important source of profit to private enterprise, and is in many countries a lucrative source of revenue to government. In the State of New York, the celebrated Onondaga salt springs have reached an astounding development within the last few years. The amount of salt inspected in 1861, on the Onondaga Salt Springs Reservation, in and adjacent to the city of Syracuse, N. Y., was 7,200,391 bushels, being equivalent to 1,440,000 barrels, of 280 lbs. each. The duties collected by the State amounted to $72,003, although the duty is only one cent a bushel. The disbursements for the support of the salt springs amounted to $45,000, and the dividend paid to the lessors of the salt vats reached 20 per cent. annum. The salt trade of Syracuse is already enormous. This important article constitutes a large share of the return freight to the boats on the Erie Canal, and the vessels engaged on the great lakes in the transportation of grain and other western productions. The quantity of salt shipped from the Reservation, not forty miles from Oswego, amounted in 1858 to four hundred and twenty millions of pounds, or equal to the load of four thousand canal boats, with cargoes from fifty to one hundred tons. This quantity would ballast one thousand four hundred sailing vessels, with one hundred and fifty tons each. Canada obtains much of her salt from importations *viâ* the St. Lawrence from Britain, but there is ample field and opportunity for manufacturing salt within our own boundaries. The shores of the lower St. Lawrence, or of the Bay of Chaleurs would probably, says Mr. Hunt of the Geological Survey, afford many favourable localities for the establishment of salines; the heat of our summers, which may be compared to those of the south of France, would produce a very rapid evaporation, while the severe frosts of our winters might be turned to account for the concentration of the water by freezing, as is practised in Northern Russia. Although we import salt to an amount exceeding $100,000 from Britain, yet the United States' salt drains us of nearly two hundred thousand dollars per annum. A Salt spring was formerly worked at St. Catherines (1835), but al-

though the brine was of considerable strength, yet owing to the importations of the foreign article the enterprise was not successful. Paper hangings, at 20 per cent. duty, cost us yearly about $80,000, of which sum we pay the United States more than $45,000. We are glad to know that home manufactures will soon diminish this outlay, and that some very excellent Canadian papers will be exhibited at our next exhibition. Who would think that our hats, caps and bonnets cost us more than a third of a million dollars a year, and that we pay the United States upwards a quarter of a million for these necessary articles. It would be at least patriotic to wear a Canadian hat, or a Canadian bonnet, and a great stimulus might be soon given to home manufactures, which are already assuming fair proportions.

Leather cost us $270,000 in 1861, and yet we exported $21,115 worth of hides. Here we plainly export the raw material and receive back the manufactured article. We pay the United States more than fifty thousand dollars a year for broomcorn, an agricultural production which can be well grown in Canada, and although it is in the class of free goods, there can be no doubt its cultivation would be profitable. Our soap cost us last year fifty thousand dollars, and we imported more than a million pound weight. We have abundance of potash for soft soap, but no soda for the hard varieties. Yet in the salt waters of the Gulf of St. Lawrence, there is a never failing store of sulphate of soda, which by well known processes can be converted into the carbonate. If common salt were manufactured in the artificial salines before referred to, which might be profitably established on the shores of the Gulf, enough soda could be obtained from which a very extensive manufactory of the more common kinds of hard soaps might ultimately spring, and thus one branch of industry would indirectly lead to the prosecution of another equally important. The finer varieties of toilet soaps are generally made from olive oil and soda, hence we should be always dependent to a certain extent on the foreign market. But for all ordinary domestic purposes, soaps from animal fat and soda are sufficiently well fitted. Our musical instruments cost us nearly $140,000; and $120,000 of of this large sum goes to the United States. The Pianos exhibited at London during the last Provincial Fair lead us to hope that this item will soon be reduced in favour of home manufactures. The progress which has been already made bids fair to show that we may soon expect to be independent of the foreigner for these delightful sources of enjoyment. The Exhibition at Toronto will furnish a splendid opportunity for native talent and industry to display itself, and it will no doubt secure a well-earned reward.

Foreign Stationery cost us $148,674 last year, of which large sum not less than $65,393 went to the United States, besides $24,913 for paper, for which we paid in the aggregate $57,826.

These are manufactures which we may hope so far to produce at home as to diminish materially our dependence on other countries for all kinds except those of the finest description.

Cabinetware and Furniture, which we manufacture largely within our own limits, nevertheless cost us last year $43,957, of which nearly $40,000 went to the United States. Although a duty of 20 per cent. is charged on these articles, yet we are still unable to supply ourselves, notwithstanding the excellent style and cheapness of most articles of domestic use manufactured in the country and a duty of 20 per cent. on importations.

The following list embraces the principal articles imported last year. Some of them it is impossible to produce at home; others might from year to year be diminished and a home manufacture substituted:—

	Valued at
Cottons	$5,690,777
Woollens	4,271.276
Sugar	1,627 781
Iron and Hardware	1,489,645
Tea	1,867,025
Silks, Satins and Velvets	921,152
Bar, Rod and Hoop Iron	713.249
Coal and Coke	732.212
Meats, fresh, smoked and salt,	507.472
Hides and Horns.	545,578

All these items with the exception of Sugar, Tea, Silks, &c., and Coal, we may hope to reduce as our population increases and manufactures become more developed by the introduction of capital and skilled labour. The field, it will be seen at a glance, is of vast extent, and yet there are thousands waiting for the opportunity to enter upon it. The unfortunate strife which distracts the United States has checked the progress of one branch of industry, namely, the Cotton manufacture, which would ere this have taken a firm root in our midst.

In concluding this sketch we wish earnestly to call the attention of our manfacturers to the forthcoming Provincial Exhibition. In another part of this issue we have adverted to the necessity of a complete representation of our industry during the present year at Toronto. In view of the disastrous civil war which cramps the energies of our neighbours, we should be ready to embrace the opportunity and take our own stand in Manufactures and Art. A well-sustained Exhibition will show what we can do alone, and there cannot

be a doubt that if manufacturers and mechanics will come liberally forward and exert themselves to display their work, it will warm into life a spirit of equally liberal encouragement and a determination to sustain home manufactures and home industry to the utmost degree.

THE INTERNATIONAL EXHIBITION.

(*Extracts continued from "The Mechanics Magazine."*)

The Eastern Annexe.

Referring to the trophy in class II. Chemical Substances and products, the *Mechanics Magazine* remarks:

"The anomaly of this trophy is that finer specimens of most of its constituents are to be seen in other parts of the class. Thus we find the most magnificent crystals of red and yellow prussiate of potash, in the case of the Hurlet and Campsic Alum Company, No. 535, and Bramwell & Company, No. 484. Of the prussiate of potash, we would remark that it fills a very important place in our manufactures. Albeit it is made from such apparently worthless materials as rotten wool, rags, hoofs, horn waste, or any other azotized organic matters. These are mixed with the impure carbonate of potash and iron filings, and, whilst being stirred with an iron rod, submitted to a red heat in close iron vessels, the whole is afterwards treated with hot water, filtered and evaporated, when crystals are obtained of ferrocyanide of potassium. By passing chlorine gas through a solution of the ferrocyanide, the ferrid cyanide is formed, or by another process, too elaborate to describe here, cyanide of potassium is the resulting product so much used in electroplating, gilding, and photography, the finest specimen of which may be seen in the case of Messrs. Hopkin and Williams, No. 530. Again, from ferrocyanide of potassium, or the yellow prussiate of potash and sulphuric acid, the deadly hydrocyanic, or prussic acid, is formed, and prussian blue is an admixture of this same substance with a salt of iron.

"We have already spoken of the utilization of the ammoniacal liquor of the gas works. This leads us to consider the truly marvellous results that have been developed in the new product, aniline, from coal tar. Not long since gas was the only product that was obtained from coal, of a profitable character. Coke could scarcely find a purchaser; tar was a bug-bear of defilement—ponds of it seemed to beg for a hiding place from the anathemas of mankind. Yet from this very tar have we now a series of most valuable and surpassingly beautiful results. Witness the crowns of dazzling beauty made from the acetate of rosaline, the crystals of which, when dissolved, form that brilliant colour, the magenta; in fact, so far as colours are concerned, a fairy-land of etherial blues, and deep rich crimsons, not to speak of violet, reds, and yellows, seem to have issued, at a touch of the chemist's wand, from the styx of all abomination, coal tar. Messrs. Perkins exhibit their beautiful blues, purple, and mauve, as also a jar of coal tar, from which they obtain twelve grains of aniline. On the opposite side is a similar jar, containing one grain of this highly dispersive and wonderful salt in water, producing in that infinitesimal quantity the colour that has been so much and so long the rage amongst the fair sex.

"Messrs. Maule and Nicholson, the manufacturers of the resplendent crowns of acetate of rosaline just referred to, have the more abundant, if not the finest specimens, of the coal tar products, and apropos of the aforesaid crowns, we must not forget one acid that has been called in to aid their production—we mean the acetic acid. It must appear wonderful enough to the uninitiated to learn that their white wine vinegar is obtained, in the form of acetic acid, from the smaller branches of the oak and other hard woods, and yet more so to learn that it is now also obtained from that apparently useless material that has so long sought a satisfactory destination—sawdust. This dust now finds itself entering the mouth of a long retort through a hopper, is coaxed forward by an endless screw occupying the whole diameter of the retort, and brought under a heat that implies *destructive* distillation, thus parting with its volatile products, and leaving the retort at the far end fairly exhausted, it has the satisfaction, whilst assuming its sombre carbonaceous form, of having become the parent of the acetates, whose names are legion, and are of so great a commercial value amongst dyers, as also in chemistry and pharmacy. Sawdust also yields, at the hands of Roberts and Dale, some fine specimens of oxalic acid. The Melinevythan Co. (case 566), as also Messrs. Wright and Francis, shew beautiful specimens of acetate (sugar) of lead; indeed the acetates are exceedingly well represented in this class.

"Passing by, though not without an acknowledgment of their usefulness, the thousand and one products that constitute our ordinary list of chemical and pharmaceutical substances, we halt ever and anon at the beautiful specimens of crystalology that has proved our chemists to have been on the *qui vive* in their contest for the palm with our Continental neighbours, and amongst these unique specimens we would mention those of the bichromate of potash by White and Co., and codeine by McFarlane & Co., indeed, a list made of even the most noteworthy would occupy far too much of our limited space, so we trust that our readers will find an early opportunity of forming their own estimate of the excellence of this department of our International Exhibition.

"A vast improvement in quality and price is shown in the alkalies, especially in soda. Our readers may remember reading in their catechism of chemistry, in their youthful days, how that soda was made from the ashes of marine plants, but most of them know that now-a-days Salt is the great source from whence we are supplied with this useful alkali. Salt is a chloride of the metal sodium; by pouring sulphuric acid upon it the sulphate of soda salt-cake is formed, and the chlorine set free.

"This sulphate of soda is then furnaced with chalk and small coal, the sulphuric acid is thus exchanged for the carbonic acid, and an impure carbonate of soda is the result. Again, lime is made to supply its oxygen in exchange for the carbonic acid, and we have, as a final result, instead of salt (the chloride of sodium), soda (the oxide of sodium), at a price just one-half that of

potash or pearl ashes, which are still made, as aforetime, from the ashes of plants. This manufacture is most ably represented by Muspratt, 571, Gaskell, Deacon & Co., 520, Hutchinson and Earle, 537, and the Jarrow Chemical Company, 540.

"Soda very appositely leads us to the grand discovery of Sir Humphrey Davy of its base, the metal sodium. This has, until lately, been seen only as a curiosity in the laboratories or in choice collections of the chemist. Judge of our astonishment to find that it may be now had for something like 3s. per lb. Exceedingly fine samples of this metal are exhibited by Bell and Co., of Newcastle, as also of aluminum. In connection with this metal, we may mention a new product, for the first time exhibited to public notice—the silicate of alumina—a beautiful crystalline substance resembling glass. It is formed by mixing two alkaline solutions of silica and alumina; from the great affinity of the alumina for the silica, a union is formed between them of a most permanent character. The bases in the mixed solution, however, showing a most energetic action in strong solutions when diluted with water have that action so retarded that they remain in the form of a liquid for some hours, admitting of many useful applications, such as the preserving of stone by induration, and the manufacture of artificial stones, which processes are exemplified in the case, No. 471, by Messrs. Bartlett Bros., of Camden Town, who are also manufacturers of very fine specimens of the silicates and aluminates of soda and potash.

"Fecula or starch has been brought of late years to a most wonderful degree of perfection, and the palm is hotly contested by Berger, Colman, Jones, and the manufacturers at the Glenfield and Springfield Works. Suffice it to say of this product, we never saw finer samples than those exhibited by the manufacturers referred to.

"Our artist colourmen seem to have outdone themselves in the superb collections they display. Windsor and Newton, Reeves, Rowney, and Newman, each and all deserve the highest praise for the skill they have shown as manufacturers, and the taste they have displayed as exhibitors. Their cases contain most valuable as well as most beautiful specimens, though the exceedingly great value of quantity should not lead us from a fair judgment of quality, a standard to which the afore-mentioned exhibitors, with others, have so ably and successfully aspired.

"A very unpretending case, yet one whose contents are of the greatest importance in a sanitary point of view, is that of Cundy, of Battersea, No. 500. We cannot dwell upon it longer than to say that the permanganate of potash there exhibited is a most powerful and innocuous deodorizer and disinfectant; its oxidizing powers are beautifully shown by treating pure and impure water; with a small quantity of the fluid each water may be perfectly pellucid or clear; but if organic matter be in solution, it will instantaneously be oxidized and precipitated as a powder to the bottom, leaving the water colourless; but if nothing of the kind exists in the water, it remains tinged with the pink colour of the fluid, which retains its normal condition.

"Smith & Co., case 604, exhibit an interesting collection of opium products. The opium eater would, we opine, gaze with bewilderment at the various products extracted from his quid, the narcotine, codeine, morphia, narceine, and meconic acid, each adding to the physicians' influence over the evils to which flesh is heir. A very nice collection of sea-weed products are exhibited by Stanford, of Worthing, proving the untiring research of the chemist into the most unpromising of substances; we may also, whilst so near the sea, call attention to the fish manure, exhibited by Whitworth, case 622. And the products used in sugar refining, in case 501, are worth something more than a glance, reminding us that the extreme whiteness of sugar is derived from the presence of the blackest of all substances, and the sweetest material in creation is made even more pure in its sweetness by contact with a property of grim death's burnt bones. Our readers will find an interesting subject in the varnishes and their gums, fine specimens of which are exhibited by Wilkinson and Co., 623, Mander Brothers, 562, and others too numerous to mention. An instance of the efforts exhibitors have made to please the eye with even the most inartistic materials, is to be seen in the case of black lead exhibited by Chick, No. 514, which certainly exhibits a high degree of perfection in its manufacture.

"Mr. R. Rumney, of Manchester, has very patriotically provided a collection of dyes and dyed fabrics, shewing the novelties and improvements that have been introduced since the year 1851. Splendid specimens of madder, garancine, and murexide, with an almost countless number of other dyes, are exhibited in class 2; and as to the gentlemen who have so skillfully and laboriously produced the more rare chemicals, their succes es and laurels will be most appropriately discussed by a more technical journal than our own."

The Western Annexe.

"A very beautiful combination of science and mechanics as applied to the art of engraving is to be seen in the Electrograph engraving machine of Mr. Henry Garside, of Coupland-street, Manchester. This is intended for the engraving of copper cylinders used in calico printing. The distinctive feature of this apparatus, apart from its mechanical arrangement, consists in the application of voltaic electricity in communicating movement to important and delicate portions of the machine. The cylinder to be engraved is first coated with a thin film of varnish sufficiently resistant to the continuous action of the strongest acids. The required number of copies of the original design are then traced on the cylinder by means of a series of diamond points arranged on the machine, in a line parallel to the cylinder. The metallic surface of the latter thus becomes exposed at the parts required to be engraved. A bath of nitric or some other potent acid is afterwards used to deepen the exposed portions to the extent required, and thus the operation is completed. The diamond points are all in connection with as many small magnets, and these are so arranged that intermittent voltaic currents are established in unison with the original design. The result is that the diamonds are withdrawn or advanced at the proper moment, and the tracery forms an exact counterpart of the copy. There are, also, adjustments, which enable the operator to enlarge or diminish

at will the size of the patterns to be engraved. It is unquestionable that this exquisitely ingenious contrivance will interfere materially with the system of hand-engraving as pursued heretofore, but, as usual in such cases, the benefits accruing to the public will be marvellously enhanced. It is not long since we had occasion to speak of a machine intended for engraving upon steel, and cutting cameos. It is to be regretted that this contrivance cannot be placed in the Exhibition beside the electrograph engraver above named. Together these machines would point out the only course which, in future, is likely to be open to copper and steel engravers, namely, the more perfect study of designing and modelling.

"As regards the steel-engraving machine, work done by which we have seen and intensely admired, we have no hesitation in saying that it is destined to revolutionize die-engraving and gem-cutting. It appears to delight—if we may so speak of an inanimate object—in the performance of the minutest elaboration of workmanship. The first process in connection with steel-engraving by machinery is to form, in wax, a model of the device to be copied. Of this an electrotype is taken with great care, and from it, as a guide, the machine proceeds to its task. As in the case of Garside's electrograph, the size of the engraving may be varied from that of the model or copy, without difficulty. Voltaic agencies are not, however, used in the actual engraving of the device—mechanical means compassing all that is required in this respect.

"It is probable that when a new Patent Law shall exist, which will deal more fairly with clever inventors than the old ones have done, this admirable discovery will see the light of day. As it is, the inventor, like many others of his class, prefers keeping the precise mode in which his machine works, a secret.

"Pursuing the subject of automatic machinery yet further, and we come to Thompson's patent universal joiner. This is the invention of Robert Henry Thompson, of H. M. Dockyard, Woolwich. It is an ingenious apparatus, capable of being worked by hand or by steam power, and applicable to a variety of purposes, as its name implies, connected with joinery. The copying principle is here again employed, and thus diversity in the form of work to be produced is no barrier to its action. It may be used for any description of joiners' work, including gothic heads, elliptic and all other curves. mouldings of whatever form, the strings of stairs, with treads, risers and handrails, together with plain or ornamental work for cabinet or coach-work.

"With some modifications, and, of course, with a change of cutting tools, the 'universal joiner' may be converted into a general mason, for it does not object, under such circumstances, to deal with stone.

"Mr. Thompson also exhibits a 'patent tree-feller,' and a 'patent sawing-machine,' and these are the natural feeders to the joiner. They perform the rough work, indeed, and the joiner the smooth.

"We have before spoken eulogistically of the sawing, planing, turning, and other machines of Worssam and Co., of Chelsea, and it would be unjust to omit equally honourable mention of Powis, James, and Co., of the Victoria Works, Blackfriars-road, who figure in similar kinds of wood-working machinery. The contractors' and builders' combined machine for planing, moulding, and edging planks or timbers on all four sides at one time, is a remarkable specimen of an economic contrivance for working on wood. So also is what they felicitously and accurately designate their '*multum in parvo*,' or general joiner. This machine will saw, plough, groove, rebate, thickness, bore, cross-cut, and strike mouldings. In its presence, therefore, the carpenter must hide his diminished head. Many other machines for the conversion of wood into the thousand forms required for cabinet operations, carpentry, pattern-making, &c., are shown by this firm, but space warns us that other mechanical wonders must pass unnoticed if we linger too long among them.

"It is not necessary to tell the generality of the readers of this journal, of the advantage which attends the existence in engine factories of ready means for sharpening tools for cutting iron, or grinding those for cutting wood. The first point is to have stones of the proper grit, and the second, to keep them in good order. This latter is frequently a matter of difficulty, from the inattention of those who use them. Mr. Muir's* grindstones are, so to speak, self-adjusting and self-repairing. He places two stones in one trough, and these work edge to edge. They are regulated by a right and left hand screw, and, by means of a cam, a slight lateral motion is given to one of them. The effect of this is to keep the grinding surfaces of both constantly "true," however unfairly they may be used by the workmen. The disagreeable, and, from the dispersion of particles of sharp-cutting dust, very objectionable process of turning down grindstones, is completely obviated in this instance.

"We have said on a previous occasion that with steam hammers the Western Annexe is well supplied. The name of Nasmyth is of course, inseparably connected with this valuable implement for the forge; and Nasmyth and Co. are represented extensively at South Kensington. Many modifications of the steam hammer have been made by different makers, with a view to overcoming some of the defects existing, or said to exist, in its original construction. Of these modifications, Robert Morrison and Co., Ouse Burn Engine Works, Newcastle upon-Tyne, display a rather remarkable example. This is called 'The Double-Acting Steam Forge Hammer.' The main point of improvement in this apparatus is comprised in the fact that the hammer bar and the piston are forged solid together. In other cases, where a different mode of attachment was adopted, the piston and piston-rod have sometimes from the violence of repeated strokes, parted company. In this instance such a catastrophe, we need not say, is next to impossible. The steam cylinder is firmly bolted to the single frame which supports the whole. This frame also contains the steam-chest, steam-passages, and the steam and exhaust pipes. The hammer-bar is furnished at its lower end with a claw for holding in the different faces or dies required for various kinds of work.

"The piston is simple in its construction, and two small steel rings fitting into grooves on its circumference make it steam-tight. Above the

*Of the Britannia Works, Manchester.

piston, the bar is planed flat on one side, a corresponding flat being left in the cylinder cover. This arrangement has the effect of keeping the bar and the hammer face constantly in the same relative position to the anvil. On the top of the hammer-bar there is a small roller which works in the slot of a lever. The lever, with the aid of a pair of links and a slide-rod, gives motion to an ordinary box slide which admits steam alternately above and below the piston.

"These arrangements comprise the distinctive characteristics of Morrison's hammer; but there are other points of detail, and especially with respect to the control exercised over it by the attendant which are worthy the consideration of those who require so formidable a forge assistant.

"The Kirkstall Forge Company, of Leeds, and 35 Parliament street, London, are also exhibitors of steam hammers, and rapidity of action is one of the principal qualifications for which they claim attention to their implements. No doubt in many cases this point is a momentous one, because the completion of a forging at one heat is very frequently a desideratum. The machines shown are massive and well constructed."

AMERICAN COURT AT THE INTERNATIONAL EXHIBITION.

(*From the Mechanics' Magazine.*)

"The display of American products at the Great Exhibition would no doubt have been greater, but for the present unhappy conflict in that country. As it is, the American Court is well worth a visit, and deserves a careful study. Scientific men will recognise in the varied and useful inventions which are there exhibited, simplicity of construction and beauty of workmanship; and the unscientific will see much to admire in the appliances by which labour is made easy and toil pleasant. American 'notions' are intensely utilitarian. Increased production at the smallest expense of labour, is their maxim. Many of the machines here exhibited are adapted to field and farm labour, and it is no disparagement of our eminent agricultural engineers to say, that, in regard to these implements, the Americans have been able to hold their own, and maintain their position against all competitors.

"On entering the court, which is at the south-east corner of the building, Wood's mowing and reaping machines occupy a prominent position. These are exhibited by Mr. Cranston, of King William Street, and have attained a large sale in England as well as in America. During the last eight years, 30,000 of them have been manufactured, 2,500 of which have been sold in England.

"The combined machine for either reaping or mowing is at present set up as a reaper, but can be easily changed to a mower, by removing the reel and platform. A self-acting rake can be adjusted to the reaper, which will deliver the cut grain in bundles at the side. The rake is worked by a pitched chain which margins the platform, and carries the teethed end of the rake round with a smooth and uniform motion, the back end being supported by a double-jointed guide. In its action it is very simple, there is no loss of power, and no risk of bruising the straw or shedding the grain. The driver, by the pressure of his foot on a spring, can stop or accelerate its motion, so that, however uneven the crop may be, the bundles deposited by the rake can be of uniform size.

"Next is the mowing machine which gained the first prize at the Royal Agricultural Society's show at Leeds, last year. Apart from the ingenious construction of this machine, it really merits inspection for the beautiful style and finish of its workmanship.

"These and other kindred machines, are producing a wondrous change on the slow, rude forms of agricultural labour. The application of science to farming is making the land more productive, and it must be a great boon to the husbandman to be able to cut down his crops of corn or grass at the rate of twelve acres a day, over ridge or furrow, and on steep hill sides, and cut them closer and better than by the scythe.

"While on the subject of husbandry, let the visitor walk straight across from these machines, and inspect some hay and manure forks manufactured by Batcheller and Sons, and exhibited by Messrs. Smith, of Doncaster. These forks look more like elegant toys than implements for laborious work. They are made of the best American cast-steel, with two, three, and four oval prongs, and are remarkable for lightness, strength, and elasticity. They are about half the weight of an ordinary English fork, maintain their perfect shape till worn out, and enable the labourer to do his work with ease and rapidity. They are the most perfect agricultural instruments we ever saw.

"In a case adjoining these are exhibited coopers' axes, chopping axes, and adzes, from the Douglas Axe Company, Massachusetts. These tools are of beautiful shape and finish; the steel is of the finest temper, and, as specimens of American cutlery, will, we think, be unsurpassed by anything of the kind in the Exhibition.

"Drake's Boring and Spacing Machine, exhibited by Mr. Wemple, Albany, N. Y., is a novel and very useful invention for boring blind stiles, or any other wood-work where a series of holes are required at equal distances apart, doing the work with great accuracy, and saving the labour of spacing and laying it out. The bits, twenty in number, are driven by one continuous belt, instead of separate belts, as in some other machines. The distance between the holes may be varied by simply moving the lever, when the transverse rods regulate the distance of the bits. The machine, though having the appearance of being complicated, is really very simple and effective, doing its work, which otherwise would be tedious, with great rapidity and precision.

"On passing Ward's Ocean Marine Telegraph, which we noticed in a recent number, we found him in the midst of a circle of enquiring visitors, who were taking a lively interest in his invention. On a table before him he exhibits two models which are worthy of notice. One is an improved wheel for railway carriages. The tread of this wheel is in form of an O G moulding, which runs with great smoothness, prevents the flange from grating against the rail, and renders it less liable to jump off. The other is a simple substitute for the ordinary castor for table legs and bed posts. It consists of a ball set in a neat brass moulding, which

runs upon smaller balls at the top, and by vertical pressure moves easily in any direction without the necessity of a joint or the liability to injure the carpet. It is one of those simple contrivances which commends itself to one's approval at first sight, and appears to be on the same principle as a turntable exhibited by the same inventor in the Eastern Annex, which we have noticed in another column.

Beardsley, of Otsego County, New York, exhibits two machines of a very American-like appearance, which have attracted considerable attention in that country. The hay elevator is intended for unloading hay into the barn, or on to the stack. The fork or lift, the points of which are three feet apart when open, move on a pivot, and are made to clutch the hay by tightening a chain. A trip-hook is put into the ring of the chain, or to unload by horse-power, a sheaved block is attached to the ridge, and another on to the floor where the horses are hitched, and as they walk off on to the ground, up goes the fork with one-third of a waggon-load at once. The trip-hook is let loose by jerking a catch-cord, and down goes the hay. By this means a ton of hay may be unloaded by five lifts of the fork. Some contrast, this, between pitching a fork full at a time, under a scorching July sun.

The earth elevator, by the same inventor, is on a similar principle. It is meant chiefly for drain cutting and ditching, and has the same object in view, rapid working, and the saving of hard labour. The elevator is hoisted in a gin, and may be worked by hand, horse, or steam power. This gin is made of four poles, twenty or more feet in length, secured in a frame at the base and meeting together at the top. Half-way up the poles are secured timbers for a railway, on which a dumping car is made to move, to receive and carry off the earth raised in the elevator. The base of the gin is twelve feet square, having wheels to roll upon plank laid on the ground. The railway may be somewhat inclined, that the car may move by its own gravity. The extreme ends of the railway may move upon wheels, the wheels moving upon a single track underneath. For making embankment or draining on a large scale, we think the machine merits attention.

"As one might expect, sewing machines are well represented—those of the lock stitch, the chain-stich, and the shuttle machine, with all their peculiarities. They are successfully exhibited, and form a great attraction. The rapidity and neatness with which these machines execute a variety of needlework is amazing to those who know only of the common needle as the grand making and mending instrument in the household, and the symbol of the most distressing drudgery. As we intend to devote a special paper to these machines, we pass them by at present. In class 1, Mr. Feuchtwanger exhibits a thousand specimens of minerals ; Mr. Meads, from Lake Superior, and the New Jersey Zinc Co., specimens of zinc ores with their products, pig and bar iron, and steel. In class No. 2, Mr. F. S. Pease of Buffalo, has a variety of mineral and animal oils for use in lubricating machinery, and as illuminating agents.

"The various oils are shewn to great advantage in glass cylinders of various altitudes, and appear to attract great attention. We have coal oil for lubrication ; oil from tar for machinery ; also signal oil, that is, oil which may be used on locomotives, on the foremast of a ship, or on a railway signal ; we have oil so limpid that it adapts itself excellently to the rapid motions of the sewing machinery, as it never gets gummy. There is a sample of oil from compressed lard of amazing transparency. The latter goes by the name of winter oil, as at 3° under freezing point it never coagulates, and is admirably adapted for the lamp in cold climates on that account. The engine and machinery oil is equal to sperm, and much cheaper; it stands a greater degree of heat and a greater degree of cold than sperm oil, and does not consume so fast. Mr. Pease has samples of petroleum in the crude and refined state, which cannot be exhibited in the building on account of the fire insurance policy. There is, further, an oil shown called 'armour oil,' which is intended especially for gun locks, and in which our volunteers may perhaps feel an interest on account of their Enfields and Whitworths.

"By the side of these oils are exhibited hops, seeds, wheat, beans, peas, buckwheat, and samples of starch and flour manfactured from Indian corn or maize, of which there are shewn a number of specimens in the ear. The starch is extolled for the gloss it gives to the linen or cotton to which it is applied. The flour is remarkably white and fine. Samples are here, too, of a farinaceous article manufactured by the Glencove Starch Company, of New York, under the name of 'Maizena.' It is the purest preparation of the finest maize. In a short time, and without any trouble it can be made into various forms of diet and is a good substitute for arrowroot

"Having disposed of these odds and ends, we proceed to notice a few mechanical contrivances and, first, near the south-east entrance one is attracted by a cork-cutting machine invented and patented by Mr. Conroy, of Boston, there is one machine which cuts the cork into parallelopipedons, and then into smaller figures of the same kind according to the length of bung or cork required. These smaller pieces are brought in contact with a knife mounted on a circular horizontal disc. The disc is put in motion by a large wheel similar to a cutler's wheel, and a band running over a drum in immediate connection with it ; or it may be worked by steam power. This disc, by means of gearing, traverses a platform from right to left, and *vice versa*, by which arrangement a cork is no sooner cut on one side than a cork is cut on the other. The square body to be transformed into a rounded is placed in a groove ; the gearing seizes it in the manner of a piece of wood in a turning lathe, by its extremities, advances it to the edge of the circular knife, and in an instant the rough block of cork appears a shaped article wherewith to stop a beer barrel, a bottle of champagne, or a medicine phial. The ease with which this machine does its work is surprising. A clever cork-cutter, working by the hand, can turn out, on the average, eight gross of corks a day. By this machine can be made fourteen gross of corks per hour. In a day of ten hours, therefore, two men can produce 20,160 corks or bungs, while two men by the hand in the course of the same time

can turn out only 2,304. The corks can be cut in perfect cylinders, or bevelled to any angle required by slightly elevating the horizontal disc. The machinery is very simple, and ingenious through its simplicity.

"A bolt is shown in one part of the court, which has all the excellency of the rivet, with this advantage over a rivet, that when required it may be moved from its place without any trouble It is well adapted for the framework of locomotives and railway carriages. The bolt passes through an iron frame, or through woodwork, and is secured behind by a nut. But inasmuch as a nut is liable to be unturned in the extremity of the thread of the screw-bolt by vibration, and as many railway accidents have happened from the fact of bolts having parted for the want of their retaining nuts, in the present case the nut is kept in its place by having a spring inserted into it, which adapts itself to the rachet work of a hollow washer. The inventors are Messrs Lawrence and White, of Melrose, N.Y. Close to the screw-rivet bolt is a contrivance for common land carriages. A coupling iron, which accomodates itself to the oscillations, of a carriage on a rough road, without inconvenience to the horse or horses, and which, fitted on the fore axle of a four wheeled vehicle, answers all its radical motions, without being pinned like the bolt under the axle. It is, in fact, a kind of universal joint, answering to every motion of the carriage or of the horse, and which, if adopted generally, is likely to prevent many accidents.

"Scholl's life-boat is constructed on a novel principle. The model exhibited is rather a rough one. It looks like a great green porpoise, with a lid opening into its back. Look into the interior, however, through the lid, and you discover the arrangements for the accomodation of a crew and passengers—for the saved and the saviours, as the case may be. The object of the boat is to pass through a heavy surf with safety. The internal fittings of the boat are below the centre of gravity and of flotation. They are hung in the manner of a binnacle compass, that is, be the motion of the external shell or hull of the boat what it may, the persons within are always maintained in a horizontal position. Indeed, let the boat turn round and round like a spindle, which is hardly possible, its passengers are nevertheless unmoved. The steering apparatus is within, and so also all the arrangements for a screw propeller. This boat has no outer deck; indeed, as we have said in form it resembles a porpoise in the model, and on a large scale it must be something 'very like a whale.'

"There are four exhibitors of pianos, all of New York city or county. These instruments vie in tone, and power, and in cabinet work, with any in the other courts of the building. In power, we suspect that they will carry off the prize against all competitors. We had the opportunity, at least, of listening to a square and a grand exhibited by Steinway and Sons. The internal arrangements of these instruments are novel; the strings are not all in parallels like those in the usual pianos; on the contrary, the bass strings are placed at acute angles above the tenor and treble strings, and obtain the full advantage of the sounding board. The motions of the hammers are not impeded by this arrangement. The grand has seven octaves, and tone loud enough for a large concert room, and yet, through the mechanical arrangements of the instrument, it can be made to play as softly as if it had been intended for a sick chamber. Amidst the many musical instruments to be found throughout the building, the visitor, curious in these things should by all means see the pianos in the American court.

THE ECONOMIC MINERALS OF CANADA.

(*Continued from page* 170.)

MARBLES.

Limestones.

Arnprior.—At the mouth of the Madawaska, in McNab, a great extent of crystalline limestone is marked by grey bands, sometimes narrower, sometimes wider, running in the direction of the original bedding, and producing, where there are no corrugations in the layers, a regularly barred or striped pattern. When the beds are wrinkled, there results a pattern something like that of a curly grained wood. The colors are various shades of dark and light grey, intermingled with white. These arise from a greater or less amount of graphite, which is intimately mixed with the limestone. The granular texture of the stone is somewhat coarse, but it takes a good polish, and gives a pleasing marble. Mr. W. Knowles has opened a quarry in limestone of this description at Arnprior, and erected a mill for the purpose of sawing and polishing it for chimney pieces, monuments, and other objects. A monument of it has been erected in the Mount Royal cemetery.—*Laurentian.*

Augmentation of Grenville.—In the township of Grenville and its Augmentation, a band of crystalline limestone, which has an extensive run through the country, presents, in many places, a peculiar variety of marble, having a white ground marked with a number of small green spots, arising from the presence of serpentine; which occasionally forms angular masses several inches in diameter. This disseminated serpentine, more or less aggregated, usually runs in bands parallel with the beds, and clearly marks the stratified character of the rock. These bands, as in the case of the Arnprior marble, are sometimes even, and at other times corrugated, giving diversities of pattern in cutting. Sometimes the serpentine, instead of green, is sulphur-yellow, as in the specimen from Grenville. In many parts of the country, the Laurentian limestones are free from foreign minerals, and give white marbles. These, however, are usually too coarse grained for statuary purposes, and sometimes they are barred with slight differences of color. The specimen from Elzivir, obtained from Mr. Billa Flint, of Belleville, is an instance of this. Many years ago, a mill for cutting and polishing a marble like the specimen from the Augmentation of Grenville, was erected on the Calumet, lot 19, range 3, of Grenville, where a similar rock occurs; but the demand for the marble was not sufficient to make the enterprise profitable.—*Laurentian.*

St. Armand.—The marbles occur in great abundance in the immediate vicinity of Phillipsburg, on Lake Champlain. They are all easily cut, and take a good polish. Should a railway, which is projected between St. John and St. Albans, be carried into operation, it is probable there would be some demand for the stone. No quarries have been opened on any of the beds, and these specimens are taken from surfaces that have long been exposed to the influence of the weather.—*Quebec group, Lower Silurian.*

St. Armand.—About a mile and a half south-eastward from Phillipsburg, there occurs a black marble, similar to this specimen. The beds dip to the eastward at an angle of about twelve degrees; a quarry was many years ago opened on one of them, which has a considerable thickness. The stone was exported to the United States, and much esteemed in New York, but the opening of quarries of black marble at Glen's Falls, where there is a great water-power, interfered with the demand, and caused the enterprise to be abandoned.—*Quebec group, Lower Silurian.*

St. Joseph, Beauce.—This red marble occurs near the river Guillaume, associated with red shales and sandstones, resembling those of Sillery, near Quebec. The red limestone is succeeded by a band of a peculiar argillaceous rock resembling the *gabbro* of the Italians.—*Quebec group, Lower Silurian.*

Caughnawaga.—Similar grey marbles, with red spots, occur in the same formation as the rock of Caughnawaga, behind the city of Montreal, and on Isle Bizard; while beds in the same formation, at St. Lin, in the county of L'Assomption, are wholly red. In all of these localities the rock is filled with fossils, which are plainly seen on the polished surfaces.—*Chazy formation, Lower Silurian.*

St. Dominique.—The marble of St. Dominique is easily cut, and takes a good polish. It is surprising that situated so near to Montreal, with a railway running near, it has not been applied to various purposes in the city, for which a stone not so good is at present used.—*Chazy formation, Lower Silurian.*

L'Orignal.—The bed from which the specimen is taken, varies in thickness from three to six inches; it is near the surface, and is easily quarried, but it has hitherto been but little used. The locality is a quarter of a mile from the S. bank of the Ottawa, four miles west of L'Orignal village, sixty-four above Montreal. The white spots are caused by small bivalve shells (*Atrypa plena,*) filled with calcspar. Of the darker variety there are two beds, of six inches and one foot respectively, near the surface, and overlying the previous bed. Blocks large enough for chimney pieces and tables are readily obtained.

Esquimaux Island, Mingan Group.—This drab colored marble occurs in great quantity on Esquimaux Island, of the Mingan group, where the stone might be easily loaded on board of small vessels. It cuts with great facility, and takes a uniform polish.—*Chazy formation, Lower Silurian.*

Cornwall.—These black marbles, from Pointe Claire and Cornwall, are derived from two beds, each about two feet thick, at the base of the Birdseye and Black River formation. These are apparently the only beds of the formation that will take a sufficiently even polish to be fit for the purpose. In the higher beds there are patches, which, from being more argillaceous than any other parts, receive but an inferior polish, and produce a bad effect.—*Birdseye and Black River formation, Lower Silurian.*

Pakenham.—The Birdseye and Black River formation at Pakenham, on the Mississippi, a tributary of the Ottawa, yields a very peculiar dark smoke-brown or snuff-brown marble. The stone takes a good polish; but small pieces of chert are sometimes met with, which renders it necessary to be careful in selecting slabs to be wrought. Mr. Dickson, of Pakenham, on whose property the bed occurs, and from whom the specimen exhibited was obtained, had at one time fitted up an apparatus, driven by the waste power of his saw-mill, to polish slabs for chimney pieces and other uses. But there was, at that time, no consumption for the material in the neighborhood, and no railway for carriage to a distance, and the marble works were abandoned.—*Birdseye and Black River formation, Lower Silurian.*

Montreal.—The Montreal marble is derived from a bed in the Trenton, and another in the Chazy formation. Slabs for chimney pieces and table tops are sawn and polished by Mr. Hammond and used for common purposes.—*Trenton and Chazy formations, Lower Silurian.*

Dudswell, lot 22, range 7.—Were the limestones of Dudswell worked, it is probable good marble might be obtained from them. The specimens exhibited, of cream-white and yellow, and dark grey and yellow, are from beds that overlie one another. The yellow streaks in both of these marbles are composed of dolomite, while the light ground of the one, and the dark ground of the other, are of carbonate of lime. When the dark grey approaches black, which it sometimes does, and the yellow streaks are narrow, the marble bears a strong resemblance to the Portor marble from Northern Italy, sometimes known as *black* and *gold.* On analysis, the resemblance between the two is farther sustained by the fact, that in both cases the ground is a pure limestone, and the yellow veins are dolomite. It is not unlikely, that if the rock were extensively quarried, some beds might be found in which the resemblance to the Portor would be closer than in the specimens exhibited.—*Upper Helderberg formation? Devonian.*

Serpentines.

St. Joseph, Beauce.—The band of serpentine, from different places on which specimens have been obtained, has been traced on the south side of the St. Lawrence, from Potton to Cranbourne, a distance of 140 miles; in forty miles of which, it is repeated twice by undulations, giving an additional eighty miles to its outcrop. It is again recognized 250 miles farther to the N. E., in Mount Albert, in the Shickshock Mountains; and about seventy miles beyond this, in Mount Serpentine, approaching Gaspé Bay. All the specimens of these rocks, which have been analysed, contain small quantities of chromium and nickel, and the band is associated in its distribution with soapstone, potstone, dolomite and magnesite. The whole of these occur in large quantities, and in them, as well as in the serpentine, chromic iron

occurs, sometimes in workable quantities. These rocks, or others immediately near them, contain the metals iron, lead, z nc, copper, nickel, silver and gold ; with the drift gold, derived from these strata, are found platinum, iridosmine, and traces of mercury. In 1847, these serpentines, from their distribution, were described in the reports of the Geological Survey as an alterated sedimentary rock. All subsequent observations have confirmed this, and beautifully stratified masses of it have at length been discovered in Mount Albert.—*Quebec group, Lower Silurian.*

None of the serpentines, and with the few trifling exceptions that have been mentioned, none of the marbles of Canada, have yet been quarried for economic purposes. All of the specimens of them exhibited by the Geological Survey, are consequently from parts of the strata that have long been exposed to the influence of the weather, and are of course inferior to the unweathered portions beneath. There appears little doubt that, in time, both the limestones and serpentines will afford a great amount of beautiful material for architectural purposes, and support a great amount of industry.

SLATES, FLAGSTONES, LIME, BRICKS, AND DRAIN TILES.

Roofing Slates.

Walton Quarry, Melbourne, lot 22, range 6. —This band of slate is in immediate contact with the summit of the serpentine. It has a breadth of one-third of a mile, and dips about S.E. $<80°$. Mr. Walton commenced opening a quarry upon it in 1860, and found it necessary, in order to gain access to the slate, to make a tunnel through a part of the serpentine. To complete this, and to expose a sufficient face in the slate to pursue profitable working, has required two years of time, and $30,000 of expenditure. The face now exposed has a height of seventy-five feet; but the band of slate crosses the St. Francis and the fall from the position where the quarry is now worked, to the level of the stream, is upwards of 400 feet, the distance being one and a half miles, so that by commencing an open cutting on the slate, at the level of the stream, a much greater exposure can be ultimately attained. Up to a comparatively recent period, the usual coverings of houses in Canada have been wooden shingles, galvanized iron or tin plate, but so many destructive fires have occurred from the use of the first of these, that they are now interdicted in all large towns. Slate, as a covering, costs about one-third more than shingles, but one-half less than tin, and one-third less than galvanized iron. In the following table are shown, 1st, the size of the slates, in inches ; 2nd, the number of such slates in a square (of 100 square feet) ; and, 3rd, the price per square at which Mr. Walton supplies his slates, placed on the railroad cars at Richmond, which is within one and a half miles of the quarry.

Sizes.	No.	Price.	Sizes.	No.	Price.	Sizes.	No.	Price.
24×16	86	$4 00	20×10	169	$4 00	14×10	262	$3 00
24×14	98	4 00	18×11	175	4 00	14× 9	291	3 00
24×12	114	4 00	18×10	192	4 00	14× 8	327	3 00
22×12	126	4 00	18× 9	213	4 00	14× 7	374	2 75
22×11	138	4 00	16×10	222	3 75	12× 8	400	2 75
20×12	141	4 00	16× 9	246	3 75	12× 7	457	2 50
20×11	154	4 60	16× 8	277	3 60	12× 6	533	2 25

The quarry has now been in operation since the spring of 1861 ; 2000 squares have been sold, and some of the slates have been sent to a distance of 550 miles from the quarry ; a quantity of them having been purchased for Sarnia on the River St. Clair. To show that slate, as a covering, is well adapted to resist the influence of a Canadian climate, it may be here stated that slates from Angers in France, have been exposed on the roof of the Seminary building on the corner of Notre Dame and Francois Xavier Streets, in Montreal, for upwards of 100 years, without any perceptible deterioration. The strong resemblance between these and the slates of Melbourne, as well as those from Bangor in Wales, may be seen in the following comparative analyses by Mr. T. Sterry Hunt :

	Welsh.	French.	Melbourne.
Silica	60.50	57.00	64.20
Alumina	19.70	20.10	16.80
Protoxyd of Iron.	7.83	10.98	4 23
Lime	1 12	1.23	0.73
Magnesia	2.20	3.39	3.64
Potash	4.18	1.73	3 26
Soda	2.20	1.30	3 07
Water	3.30	4.40	3 40
	100.03	100.13	99 63

The proximity of the serpentine leaves no doubt as to the geological horizon of these slates.—*Quebec group, Lower Silurian.*

Cleveland, (formerly Shipton), lot 6, range 15.—The Cleveland slates are a continuation of the Melbourne band. The Shipton Slate Company opened a quarry on them in 1854, and found them to be of superior quality. This quarry is now for sale. The slates of Orford may be on the same band, about ten or twelve miles to the S. E. ; but the geological horizon of the Tring slates is uncertain, though they probably belong to the Quebec group. The Kingsey slates appear to be lower in the series than the magnesian group of strata.—*Quebec group, Lower Silurian.*

Flagstones.

Georgetown, Esquesing.—This is a hard, fine-grained sandstone ; and the surfaces are even and parallel. Many of the beds of the band, which is twenty feet thick, can be split into flagstones ; which are used in the city of Toronto. Similar flagstones, used at Hamilton, are obtained from the same band there, and an equally good quality can be obtained wherever the band occurs.—*Grey band, Medina formation, Lower Silurian.*

Hydraulic Lime.

St. Catherines.—The bed which forms the Thorold cement is a dark brown dolomite of the Clinton formation. During the construction of various railway, and other public works, the quantity of cement manufactured by Mr. Brown averaged 80,000 bushels annually, but at present the quantity made does not exceed one-tenth of the amount. The present price of the cement is from twenty to twenty-five cents per bushel of sixty lbs.—*Clinton formation, Middle Silurian.*

Walkerton.—The beds of this deposit are from two to eleven inches thick, occasionally separated by layers of shale, making in all fifteen feet. Cement has not yet been manufactured from this stone; and none is made within 100 miles of the

locality, although there would, no doubt, be considerable demand for it in the neighborhood, were it prepared at the place. The locality is in the bank at a mill-dam on the Saugeen River, where an unlimited water power for grinding the cement may be had.—*Onondaga formation, Upper Silurian.*

Limehouse.—This stone occurs in a band of nine feet thick, in beds varying from three to seven inches. The cement is manufactured in considerable quantities by Messrs. Bescoby and Newton. It sets slowly, and hardens during several weeks, after which it is said to possess great strength.—*Clinton group, Middle Silurian.*

Nepean.—Though the rock occurs in Nepean, its produce is usually designated as the Hull cement, from having been manufactured for several years, by Mr. Wright of Hull, opposite to Ottawa. The rock is a limestone holding about 12 per cent. of carbonate of magnesia, and it yields a strong and lasting cement. The bed to which it belongs, has been traced for nearly 100 miles through the country, preserving a very uniform character.—*Chazy formation, Lower Silurian.*

Rockwood.—This specimen comes from a band three and a half feet thick, associated with a layer of chert, and separating into beds averaging six inches. It is not worked, but could be easily quarried, and a good water-power for grinding is ready at the spot.—*Niagara group, Middle Silurian.*

Magdalen River.—These specimens of black dolomite are derived from the Mountain Portage, about five miles up the Magdalen River from its mouth. The stone occurs in beds of from two to four inches, interstratified in black graptolitic shales, and yields a very strong hydraulic cement, setting in a few minutes under water, to a very hard and tenacious mass of a yellowish colour. Similar bands occur at the Grande Coupe, six miles below Great Pond River. The range of the formation containing these bands, being from Gaspé to Quebec, makes it probable that a considerable quantity of the stones may be obtained from various places along the south shore of the St. Lawrence. The stone differs from that at Quebec, from which Capt., now Major General Raddeley, R. E., first prepared a cement, now manufactured by Mr. P. Gauvreau. This contains no magnesia, while the Gaspé stone is a dolomite.—*Hudson River formation, Lower Silurian.*

Brick.

Montreal.—The red bricks of Montreal are manufactured from a blue clay of marine origin, which is interstratified with reddish layers, and runs under a deposit of sand. The clay has been excavated to a depth of twenty feet, and may be deeper, as the same formation is known to have a greater thickness in other localities. Its marine origin is proved by the occurrence of sea shells, of about six species in the pure clay, and about thirty in the sand clay immediately overlying it; all probably the same as species now inhabiting the ocean. Our knowledge of the fossils of these deposits has been greatly extended by the researches of Dr. Dawson, of McGill College, who has more than doubled the number of shells known a few years since, and added to the list many species of *Bryozoa. Foraminifera*, and other small forms. The remains of the capeling (*Mallotus villosus*) and the lump-sucker (*Cyclostomus lumpus*) are obtained ffom the same clays near Ottawa, and a clay pit of Messrs. Peel & Compte, on Côteau Baron, has yielded nineteen of the caudal vertebræ of a cetacean, similar to a species discovered in Vermont by the late Mr. Zadock Thompson, and named by Mr. C. H. Hitchcock, *Beluga Vermontana.* On Côteau Baron these remains were accompanied by one of the pelvic bones of a seal, by sea-shells, and by fragments of white cedar, *Thuya occidentalis.* The locality is about 140 feet above the level of the sea. In another of Messrs. Peel and Compte's pits there has recently been found a nearly entire skeleton of the Greenland seal (*Phoca Grœnlandica*), a species still living in the Gulf of St. Lawrence; from the size of the head, the animal appears to have been six feet long, and full grown. Within a few days, a clay-pit of Messrs. Bulmer & Sheppard has given many of the bones of some other animal, supposed to be a seal, of much smaller dimensions. The brick yards are situated to the north-east of Mount Royal, on a plateau of considerable extent; above which, well-marked sea margins occur on the sides of the mountain, at elevations of 220, 386, 440 and 470 feet above the sea level, with marine shells up to the last mentioned height.—*Alluvian.*

Hanover, Brant, Geological Survey.—The specimens are manufactured from a brownish laminated clay, which burns white, and is underlaid by a considerable deposit of sand. Either red or white bricks are made of this clay, according to the sand used.—*Drift.*

Toronto, White Bricks.—The deposit of clay, from which these white bricks are manufactured at Toronto, has a thickness exceeding sixty feet, and extends eastward, at least as far as Cobourg. It appears to be unconformably overlaid by a bed, which is three feet thick, giving red bricks. The white brick clay lies in very even horizontal strata while the other undulates with the general surface, not however descending to the bottom of deep ravines. The average annual manufacture of white bricks in Toronto is from three to five millions, and the ordinary price at the kiln is from $5.50 to $6.00 per 1000. The price of common red bricks is from $3 to $4 per 1000, and the average annual manufacture, including all kinds, is from eight to ten millions.—*Drift.*

Drain Tiles.

Quebec.—H. O'Donell, C. E., Quebec.—These tiles are manufactured by Messrs. W. & D. Bell, from a deposit of clay, varying in thickness from three to thirty feet, on the river St. Charles, between one and two miles from Quebec. They are used for main sewers and house drains, in the city of Quebec, where 151,000 feet of them have been laid. They are united by means of rings of the same material, which cover the joints, and permit alterations and repairs without breaking the pipes. When in place, the pipes are capable of resisting a pressure of fifty lbs. to the square inch, and, when properly glazed with a composition, (the base of which is oxyd of lead), which is applied either within and without, or within only, they remain free from the incrustations that are found to gather on the inside of iron pipes. The prices of these drain tiles are:

4 in.	6 in.	9 in.	12 in.	15 in.	18 in.	inter. diameter.
$0.15	$0.21⅔	$0.33⅓	$0.60	$0.84	$1.13½	per linear foot.

Proceedings of Societies.

LOCAL COMMITTEE FOR THE PROVINCIAL EXHIBITION.

The different buildings now being erected under the several contracts with the Local Committee, for the purposes of the Exhibition, are progressing very satisfactorily, and may be expected to be ready by the 1st of August, the time named for their completion.

These buildings are all of a permanent character, strongly framed, and with good shingle roofs. The Horse Stables are three in number, each 184 ft. by 32 feet, with stalls and boxes for 200 horses and are placed in the form of a quadrangle, with an open court towards the main Exhibition Building. The Cattle Sheds are in size and position corresponding to the horse stables, with accommodation for 330 head of cattle. A raised open passage, 8 feet in width, runs through the centre of each shed, between the two lines of cattle.

These erections stand on the Eastern portion of the Exhibition Grounds—the Stables on the North side of the line of King-street, and the Cattle Sheds on the South side.

The Building intended for heavy Machinery and Carriages is 256 feet by 42 feet, standing 60 feet north of the Crystal Palace, and exactly parallel with it.

Mr. Thomas Storm, of Toronto, is contractor for the Horse Stables, at a cost of $3,660; Mr. F. C. Walker, of Hamilton, for the Cattle Sheds, at $2,434; and Mr. J. W. Mason, of Toronto, for the Machine Shed, at a cost of $875; making a total of $6,969.

The funds placed at the disposal of the Committee, up to the present time, are $6,000 from the Corporation of the City of Toronto, and $1,200 from the Council of the Agricultural Association*—making altogether the sum of $7,200, or $231 over and above the amount of the contracts already entered into. Some necessary levelling around the Buildings, and other expenses already incurred, will fully absorb this balance.

The Municipal Councils of Ontario and Simcoe have been applied to, to contribute their quota towards securing the other necessary accommodation for the Exhibition, such as Sheep and Pig Pens, and Poultry Sheds. The Committee look for a liberal response from these counties, as they are to a certain extent as much interested as the city of Toronto, which has already voted for buildings for the past and present Exhibitions the sum of $26,000, besides expending several thousand dollars in draining, levelling and planting the grounds.

The Local Committee meets every Saturday, with few exceptions, either at the rooms of the Board of Arts and Manufactures, or at the Exhibition Grounds.

* The sum of $1,000 had been voted by the Municipal Council for the Counties of York and Peel, towards the Prize List of the next Exhibition; the Council of the Association, therefore, felt it to be their duty to vote to the Local Committee a sum equal to that amount, which, with an additional sum of $200, was promptly done.

THE "CITY OF TORONTO ELECTORAL DIVISION SOCIETY."

A meeting of the Directors of the "City of Toronto Electoral Division Society" was held at the rooms of the Board of Arts and Manufactures, on Monday, the 9th of June, when the following resolutions were unanimously adopted:—

Resolved—"That the entire funds of the Society, after meeting all liabilities of the year, be paid over to the Provincial Association; thereby securing to the members all the privileges of members of the Association."

Resolved—"That members of this Society, for the present year, be each presented with a copy of the "Agriculturist," or the "Journal of the Board of Arts and Manufactures," at their option."

The annual subscription to this Society is $1, which may be paid to the Secretary and Treasurer, Mr. W. Edwards; or to James Beachell, *President;* Rice Lewis and J. D. Humphreys, *Vice-Presidents;* Col. E. W. Thomson, A. Shaw, R. L. Denison, G. Leslie, J. Gray, J. Fleming, and W. H. Sheppard, *Directors.*

TORONTO MECHANICS' INSTITUTE.

A meeting of members of this Institution was held on Tuesday, July 1st, in accordance with a Resolution adopted at the annual meeting, on motion of Mr. C. Pearson, for the purpose of "initiating a series of meetings for the discussion of matters of practical interest to mechanics." The first Vice President, Mr. W. Edwards, occupied the chair and explained the object of the meeting.

The meeting was not numerously attended, but several of the members present spoke warmly in favour of at once proceeding to initiate the meetings, believing that great benefits would eventually result to the mechanic members of the Institute, by the discussion of such topics as are calculated to add to their knowledge of practical matters, and to improve their taste.

Mr. Pearson moved to postpone the commencement of these discussions until about the 1st of October next, and in the mean time to offer two prizes for 1st and 2nd best lists of topics suitable

for discussion. This proposition not being agreed to, it was moved by Mr. W. H. Sheppard, and resolved,

"1st. That the Directors be requested to give a Class Room and light for the purpose contemplated by the meeting, and that the undersigned pledge themselves to meet once a fortnight, as far as may be convenient for them to do so, for the purpose of taking part in or promoting the contemplated discussions."

"2nd. That the meetings be opened by the reading of an original paper, or an extract from some reliable author, upon the subject proposed for discussion, by some person previously appointed for the purpose; and that it shall then be the duty of the members present to make such practical remarks, and propose such questions, as may occur to them as bearing upon the subject; to bring forward the ideas of other authors, and to elucidate the subject as much as possible."

"3rd. That the next meeting be held on Friday, the 25th of July; and that the subject for discussion at said meeting be *Heating and Ventilation of Buildings;* and that all members taking an interest in the subject be invited to attend."

Eleven members subscribed their names, when the meeting adjourned.

WHITBY MECHANICS' INSTITUTE.

The annual meeting of this institution was held on Thursday, May 30th, at the hall of the Institute; the president- J. Hammer Greenwood, Esq., occupied the chair.

After reading the minutes of the previous annual meeting, which were adopted, the president read the report of the General Committee, from which we learn that the members number 267, being an increase of 63 during the year. Seventeen lectures were delivered during the past season, which were all well attended. The library at present contains 808 vols, 153 of which were added by purchase during the year. During the same period two hundred members availed themselves of the use of the library, the number of vols. issued being 2,965. This is an increase of 61 reading members, and 591 vols. on the present year. The receipts from all sources amounted to $857 58, and the expenditure to $847 83. The auditors' statement shews assets to the amount of $2,543 50, and liabilities to 1st April $52 80. The report suggests the increase of the members annual subscription, which at present is only one dollar.

On motion of Mr. McCabe, seconded by Dr. Ham, the report was adopted. The auditors' report was also adopted, and the thanks of the meeting voted to the retiring officers.

The following were then elected officers for the ensuing year:

William McCabe, *President*—A. F. McPherson, *Vice-President*—John Shier, *2nd Vice-President*—Mr. Thwaite, *Recording Sec'y*—Rev. K. Maclennan, *Corresponding Secretary*—James Bain, *Treasurer*—H. Fraser, *Librarian.*

General Committee.—Messrs. John Ferguson, Major Harper, M. O. Donovan, J. Bengough, Alex. Mason, S. H. Greenwood, Geo. Hopkins, J. H. Perry, James Draper, and G. Y. Smith.

Resolutions were passed instructing the committee to arrange for an excursion trip under the auspicies of the institute, during the summer, if they deemed the same practicable; presenting the Rev J. T. Byrne with a life membership, in token of his services, and appointing a committee to wait on him therewith; and conveying the thanks of the members of the Institute, to the Trustees and members of the Whitby Division of the Sons of Temperance, for the liberal surrender and sale made by them of their interest in the Hall.

The meeting then adjourned.

THE PROVINCIAL EXHIBITION.

The speedy approach of the Provincial Exhibition reminds us of the necessity of again calling the attention of manufacturers, artizans and mechanics to the value and importance of securing a complete representation of their several departments of industry at Toronto, in September next.

There can be no doubt whatever that the Provincial Exhibition of 1862 will far surpass in all details any of its predecessors, and a better opportunity for display has never yet occurred in the history of the Province.

The large amount of prizes devoted to the Manufacturing Department, and the new arrangement which has been adopted by the Board of Arts and Manufactures will no doubt prove acceptable to many who have hitherto been disposed to express disapprobation at the small amounts awarded. A sum exceeding two thousand dollars, varying from thirty dollars downwards, is itself an attraction, but we believe that the spirit of emulation, which is now beginning to be developed, will alone be sufficient to secure for the Arts and Manufacturing Department of our Exhibition in September next a far better representation of the manufacturing industry of the country than has ever hitherto been made.

ELECTRIC APPARATUS.

By an ingenious contrivance, an Electric Apparatus is attached to the turnstiles at the entrances of the International Exhibition Building, and communicating—by means of a line of copper wire laid across the building—with the finance office of the Commissioners. This instrument is worked without battery-power of any kind, the electricity being generated by a magnetic machine of peculiar construction, connecting with the turnstiles in such a manner as to discharge a current at each revolution of the stile, registering the passing through of each individual, and establishing a complete check upon the money takers at the door.

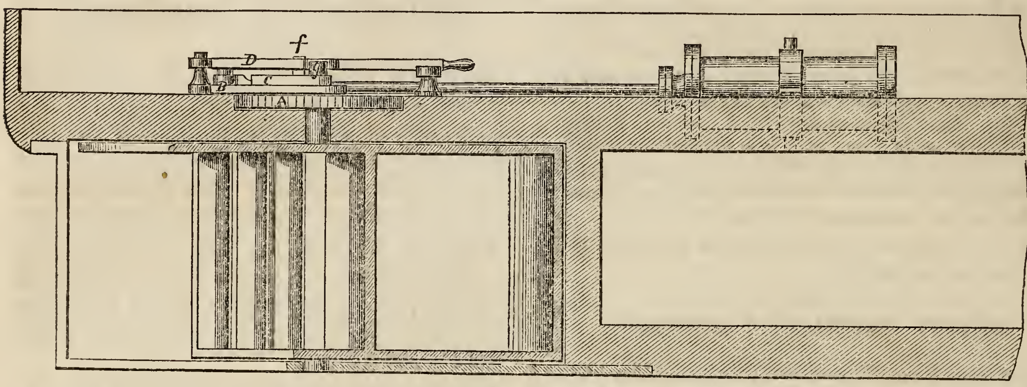
O'HARA'S LIGHT DRAFT PROPELLER.

A great requirement of the present age is a means of propelling by steam power canal boats, by some instrument of propulsion not liable to the well known objections of the paddle-wheel, or screw propeller.

The accompanying engraving illustrates an original propeller designed by Mr. Charles O'Hara, of London, England, (formerly of Toronto,) especially for canal navigation, its object being to propel a boat by a comparatively small expenditure of steam power, by obviating the mechanical disadvantages of crank movements, lift-water, &c., and to cause no surge injurious to canals or their banks.

The propeller is represented detached from a vessel in a perspective view in Fig. 4. It is of semi-cylindrical form, resembling one-half of a cylindrical grindstone with its axis attached; the surfaces on each side of the axis are corrugated or fluted, and the adaptation of the propeller and axis to a vessel and steam-engine is illustrated in Fig. 1. The form of the stern of a vessel for the reception of the propeller is shewn in Fig. 3. The circular surface of the propeller moves close to the surface of the concave or recess at the stern of the vessel as close as possible without touching it.

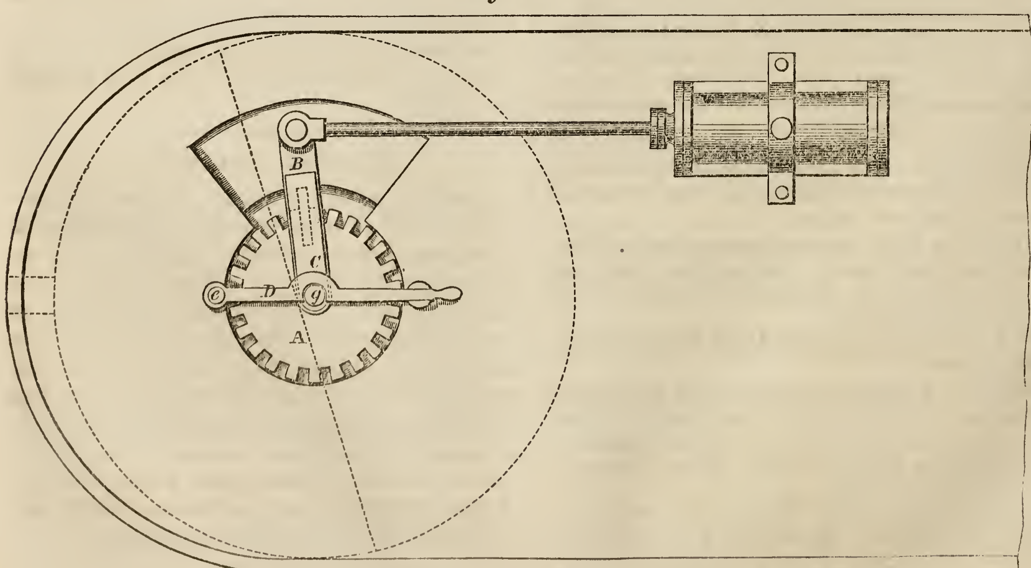
Fig. 1



In Fig. 2 the attachment of the propeller to the engine is represented, and it will easily be perceived that the action of the piston of the engine drives the fluted surfaces of the propeller through the water between those points most favourable to direct propulsion, alternately, and thus the vessel is propelled forward.

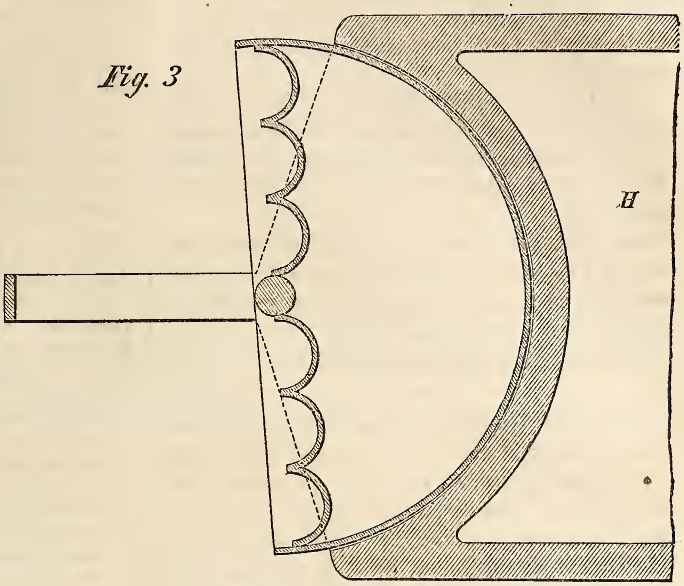
When it is necessary to back the vessel, the propeller is turned round so that the fluted surfaces are opposite the concave at the stern of the vessel, and the reversion is effected by a simple contrivance illustrated in Fig. 2.

Fig. 2



The cog-wheel A is rigidly fastened to the propeller, and the arm B, to which the piston rod is attached, is freed from the propeller by the withdrawal of a bolt which passes through a slot in the arm, and passes into any one of the cogs in the wheel; by this arrangement the propeller may be made to oscillate in any position required, and the boat may be suddenly turned out of its course by the action of the propeller.

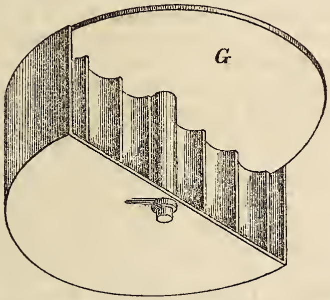
Fig. 3



The inventor of this propeller claims the following advantages for his invention.

1. Simplicity in structure and cheapness in manufacture.
2. Simplicity and cheapness of engine used in connection with it.
3. Very direct action.

Fig. 4



4. No loss of power by lifting water or displacing it, as is the case with the paddle-wheel and screw.
5. Great reduction in the consumption of fuel.
6. For floating batteries, the propeller is submerged and all the machinery may be placed under the water line.
7. No surge is caused by it in canals, to injure or wash their banks, and no rapid vibrations tending to injure the boat or its machinery.
8. On the shortest notice the propeller may be placed in a position to turn the vessel rapidly out of its direct course.

Patents for this invention have been secured in England, Canada, France, and the United States, and information regarding it may be obtained by addressing the assignee.

Walter O'Hara,
Toronto, C. W.

RECENT CANADIAN INVENTIONS.

Fleming's Farm or Railway Fence.—This Fence is straight and in panels of any convenient length. It rests on the surface of the ground, or rather the cross-sills which form the base and termination of each panel are partially imbedded in the ground. Two uprights are made to fit corresponding holes in each cross-sill, in such a manner as effectually to exclude moisture. The uprights are bound together, and also to the upper rail, by a bolt and nut. The panels are then filled with rails, laid the one on top of the other alternately.

The material composing the Fence may be prepared three different ways, according as it is found to be most desirable, either as regards economy, neatness, or durability, viz :—

1st. To have it all of sawn lumber.

2nd. To have it partially sawn and partially split.

3rd. To have it all split.

The advantages claimed by the Inventor for this kind of Fence are various :—

1st. It has the merit (in common with all others made to rest on the ground) over a post and board Fence, viz: that the upheaval caused by frost has no effect whatever, while the rigidity and binding together by the bolt, aided by the cross-sills being imbedded in the ground, enable it to resist effectually a gale of wind that would blow down any other kind of Fence constructed to rest on the ground.

2nd. It is less expensive than a post and board Fence, while at the same time it is equally straight and neat.

3rd. It can be all made of split cedar, and consequently in addition to its cheapness it is more durable.

4th. It can be built on any kind of hilly ground, and be as effectually strong as on the level plain.

5th. It will go less out of repair than any other Fence, and in point of fact requires no repair for many years.

6th. It can be all taken apart if necessary, and rebuilt at any other place required, with ease and despatch, and without the loss or destruction of any portion of the Fence.

Invented by D. Fleming, Toronto.

Keachie's Strapless Skate.—The sole of the Skate is made of steel, in the usual form. The part on which the foot rests is brass, and screwed to the Skate. The forward part of the Skate, *i. e.* the part nearest the toe, has two screws inserted in the brass foot-piece, on which is placed an iron plate with two mortices, about half an inch in length, for the heads of the screws to work in, the front end of the mortice being made sufficiently large for the screws to go through. The back part of the mortice, *i. e.*, the part nearest the heel, fits the screw tight, the upper part being bevelled to fit the under side of the screw head, which holds the Skate tight to the foot when the plate is pressed forward.

The iron plate is fastened to the boot with four small screws, and so adjusted that when the foot is pressed forward the heel of the boot will fit close to the spring. A small iron plate is fixed to the heel of the boot, with a hole for a pin to pass through; also a small mortice for a catch to work in. A spring is worked by a ring, which screws the heel part of the Skate to the foot in the firmest manner, much firmer than is possible to do with elastic straps in the ordinary way.

The Inventor claims that its security and simplicity saves much time in putting on and taking off Skates, which is of the greatest importance to Skaters, particularly in very cold weather.

2nd. The inconvenience and unsightly appearance of straps is done away with, leaving the foot free.

3rd. The greatest benefit to be derived from this method of fastening Skates is that it gives the foot free action, and does away with the cramping and benumbing the feet, which always occurs in the old method.

Invented by George C. Keachie, Brantford.

Copper containing twenty-four per cent. of phosphorus, will resist a strain of 48,000 lbs. to the square inch.

PATENTS OF INVENTION.

Bureau of Agriculture and Statistics, Quebec, 21st June, 1862.

His Excellency the Governor General has been pleased to grant Letters Patent of Invention for a period of Fourteen Years, from the dates thereof, to the following persons, viz:

James Rogers Armstrong, of the City of Toronto, County of York, Iron Founder, for "A new Design of a Cooking Stove, styled "The Maple Leaf."—(Dated 29th November, 1861.)

Elihee Stead, of the City of Toronto, County of York, for "A composition of matters to clarify and deodorize Canadian Rock Oil and Coal Oil."—(Dated 26th March, 1862.)

James E. Thompson, Gas Engineer, and Henry Y. Hind, Professor of Chemistry and Geology, both of the City of Toronto, County of York, for "An apparatus for the manufacture of Illuminating Gas from Crude Petroleum or Rock Oil."—(Dated 28th March 1862.)

James E. Thompson, Gas Engineer, and Henry Y. Hind, Professor of Chemistry and Geology, both of the City of Toronto, County of York, for "A Process for the manufacture of Illuminating Gas from Crude Petroleum or Rock Oil."—(Dated 28th March, 1862.)

Cyrenius Chapin Roe, of the Town of Brantford, County of Brant, Machinist, for "A Horizontal Endless Chain or Rope Horse Power."—(Dated 10th April, 1862.)

Samuel Conover, of the Township of Toronto, County of Peel, Yeoman, for "An article called "The Victoria Concave Washing Machine."—(Dated 12th April, 1862.)

David Elon Norton, of the Town of Bowmanville, County of Durham, Machinist, for "A new and improved Straw Cutter, called "Morton's Diamond Straw Cutter."—(Dated 12th April, 1862.)

John Walmsley, of the Village of Berlin, County of Waterloo, Waggon Maker, for "A machine called a "Combined Sower and Cultivator."—(Dated 12th of April, 1862.)

Charles Bodley, of Mount Forrest, Counties of Wellington and Grey, Carpenter and Fanning Mill Maker, for "An Improved Sifter Fanning Mill and Elevator."—(Dated 12th April, 1862.)

Moffitt Forster, of the Village of Glen William, County of Halton, Miller, for "An Improved Safety Whipple—Tree and Spring closed Hold backs."—(Dated 12th April, 1862.)

James Lorenzo Gage, of the Village of Dacotah, County of Halton, Merchant, for "A Bag Fastener."—(Dated 12th of April, 1862.)

Robert Parr, of the Township of Darlington, County of Durham, Yeoman, for "A Hair and Feather Cleanser and Renovator."—(Dated 15th April, 1862.)

James Dalgarno, of Chatham, County of Kent, Moulder, for "An Instantaneous Adjustment Wrench."—(Dated 15th April, 1862.)

Joseph A. Mardin, the younger, of the Township of Barnston, District of St. Francis, Blacksmith, for "A new and improved Punching Machine, called "Mardin's Punching Machine."—(Dated 22nd April, 1862.)

Edward Long, of the City of Montreal, Carpenter and Joiner, for "A new method of preparing signs

and plates, designated "Edward Long's Adjustable Letters and Figures."—(Dated 22nd April, 1862.)

Richard Rogers, of the City of Montreal, Plasterer, for "A new composition of matter to be used in the manufacture of blacking-pots, pomatum-pots or similar articles."—(Dated 22nd April, 1862.)

Ulric Joseph Martineau, of the parish of Longueuil, Tinsmith, for "An improved Metal Roof, made with galvanized iron or other metals."—(Dated 20th May, 1862.)

ABRIDGED SPECIFICATION OF ENGLISH PATENTS.

2783. H. Orth. *An improved soap.* Dated Nov 5, 1861. This consists of a mixture or combination of about 100 parts in weight of finely levigated clay, such as pipe clay, china clay, or other aluminous or siliceous earths; 20 parts of caustic alkali, such as caustic potash, caustic soda, or caustic ammonia, or the carbonates or bicarbonates of soda, potash or ammonia, corresponding to an equal amount of caustic alkali, and 20 parts of resinous matter, such as ordinary fine resin of a similar nature capable of being saponified. These proportions may be varied according to the quality of the soap it is desired to obtain. In preparing this soap, the resinous and alkaline or caustic alkaline ingredients are mixed with about 50 parts by weight of water, and boiled together, ebullition being continued until the alkali and the resin are combined and saponified. The saponified mass is then mixed with the argillacious or earthy matters, the whole being worked into a homogeneous paste, which is afterwards dried, and which is then ready for use.

2784. G. T. Bousfield. *Improvements in electro-plating or depositing metals.* (A communication.) Dated Nov.5, 1861.

This consists in the use of a solution of fused cyanide of potassa of great strength, in connection with a powerful galvanic current, whereby the patentee is enabled to plate iron and other metals rapidly and economically with copper, without the use of either sulphate or cyanide of copper, and without danger or inconvenience to the workmen.

2789. F. H. Schroder. *Improvements in evaporating and in machinery employed therein.* Dated Nov. 6, 1861.

This invention is intended chiefly to apply to the evaporation of the liquid parts from sugar when in a state of syrup, in order to obtain it in a crystalline condition. It is, however, applicable to evaporative purposes generally. The invention consists in placing the syrup, or other matter to be evaporated, in an open pan heated by steam or hot water, let into a jacket or case, in which the pan is placed, and in causing a series of concentric cylinders, through which a blast or current of hot or cold air is forced, to revolve in the syrup, a portion of the cylinders being continually in the cyrup and another portion revolving in the atmosphere. The cylinders are each formed with slots running in the direction of their length.

2877. E. Loomes. *Improved machinery for moulding bricks, tiles, and other like articles.* Dated Nov. 15, 1861.

This consists in adapting to the lower end of the pug mill shaft one, two, or more eccentrics, cams, wipers, &c., in combination with moveable stops, against which the clay or substance to be moulded is pressed by the cams or wipers as they move round. By that means the clay is squeezed between the curved surfaces of the wipers and the stops, and will thereby be forced out of the mill through the apertures provided for the purpose, and will be pressed into or through moulds or dies.

COST OF SHIPPING PETROLEUM TO LIVERPOOL.

In answer to numerous questions respecting freight of Rock Oil, &c., we publish such information as we have been able to obtain from reliable sources:—

1. The Well to Wyoming Station, 40c. to 50c. per barrel.

2. Wyoming to Sarnia, free of dockage and storage 28c. per barrel.

3.	"	Hamilton,	" 60c.	"
4.	"	Montreal,	$1 20c.	"
5.	"	Quebec,	1 38c.	"
6.	"	Portland,	1 60c.	"

$10 per car of (58 barrels) is charged for unloading and dockage at these three last-named ports.

7. Freight has been taken this season at $4 per barrel from Sarnia to Liverpool.

8. Crude oil has recently been purchased at the wells by some of our merchants, at 25c. to 30c. per barrel.

9. Barrels average 40 wine gals., and weigh about 350 lbs. These rates are in actual operation, and may be relied upon. Nothing comparatively has been shipped from St. Clair ports below Sarnia, which, via Great Western Railway, is the favourite route on the St. Clair river; costing, as shown, about 78c. per barrel from the wells to Sarnia,—which, with the price of the oil, 30c., and freight thence to Liverpool, $4, would bring the cost per barrel in Liverpool harbour to $5.08.

The Hamilton route has not been tried, shippers preferring the Lower Canadian ports and Portland.

With regard to our canals, a vessel of 200 tons burden, drawing 8 feet 9 inches of water, has just returned from a trip to Montreal, paying for towage and other fees (no lockage) from Toronto to Montreal and back, the sum of $160. The length of locks on the St. Lawrence Canal is 200 feet, width, 45 feet; average depth of canal, 9 feet. Locks on the Welland Canal* (in passing up to the St. Clair) length, 150 feet, width, 26 feet 6 inches; depth, 9 feet.

* The Welland Canal is 28 miles in length, and has a rise of 334 feet from Lake Ontario to Lake Erie, through 37 locks of 150 feet in length and 26½ in width, and is passable from lake to lake by vessels 134 feet over all, 26 feet beam, and 9 feet draught, stowing 3,000 barrels of flour under deck.

Shipments of oil by the Great Western Railway during the year:

January, 1862	11,775	barrels.
February, "	2,211	"
March, "	4,750	"
April, "	1,438	"
1st to 23rd of May	3,744	"
	22,908	"

Equal to 956,320 wine gallons.

SHIPMENTS OF PETROLEUM.

From the Toronto Globe.

Several cargoes of Petroleum have now cleared for European ports from Canada, and in a month or two the prices will be well established. Until these shipments arrive, the market can hardly be tested, as what has hitherto been shipped, last fall and winter, has only been small lots of 20 to 50 barrels as samples. We notice the following shipments: the barque "Prince of Wales," from Sarnia, with 2,800 barrels for Queenstown; part of this cargo was lost in the canal the barge striking the locks. The brigantine "Snow Bird," cleared from Quebec for London on the 28th ult,, with about 1,450 barrels. This vessel is owned here by G. H. Wyatt, and A. M. Smith & Co., as well as the cargo, with the exception of 500 barrels shipped by Myles & Co. The schooner "Gulnare," owned by Messrs. Myles & Co., is now loading 1,100 barrels for themselves and Messrs. Matthews & McLean of this city. The brig "Chieftain." loaded at Sarnia for Queenstown, Ireland, with about equal to 1,700 barrels. In addition, we understand, the schooner "George Laidlaw" is going to load for Messrs. J. E. Ellis & Co., of this city, for London. She will likely load at Sarnia and fill up at Quebec.

The freight paid was $4 per barrel from Wyoming station to Liverpool. From Quebec to Liverpool, $2 per barrel of 40 gallons; and to London, $2 50 per forty gallons The rate of insurance on good ocean vessels, without deck load, is from 2½ to 3 per cent.

SMITH & JONES' NAPHTHOMETER, OR BENZINE DETECTOR.

We have received a copy of a little pamphlet, written for the purpose of explaining the construction and mode of operation of a "Benzine Detector," invented and patented by Horace J. Smith and Woodruff Jones. The inventors say:

"The want of a ready and reliable means of detecting dangerous and explosive Coal or Petroleum Oil, has long been felt. The great competition, which exists at present, induces many refiners to sell as "Non-Explosive Coal" that which is entirely unsafe to be used in the family, and the numerous accidents which have occurred with such articles, have created a prejudice in the minds of many against *all* oil, which can only be removed by having a simple means of testing the quality of any that is offered for sale. Since refined Petroleum is comparatively a new article, and its properties but little understood by the public at large, it is very natural that it should be looked upon with suspicion.

The difficulty of detecting a dangerous oil is great. The crude or unrefined oil consists essentially of three ingredients, which are to be separated by the process of refining; these are Benzine or Naphtha, Illuminating Oil, and Lubricating or Heavy Oil. The properties of these when *separated* are very different and distinct, but when *mixed*, it is difficult to detect the quantity of each, or even, in many cases, the admixture. They each differ materially in specific gravity; the Benzine marks 65° on Beaume's hydrometer, the Illuminating Oil 45°, the Heavy Oil 35°; but they may be mixed together in all proportions, and the specific gravity of such compounds will generally be a mean between the gravities of the several parts. Thus, if we mix Benzine and Heavy Oil we can obtain a liquid of a gravity of 45°, exactly that of Illuminating Oil. Now, since the danger is due to the presence of Benzine, on account of the vapor which so readily arises from it and its great inflammability, such a mixed oil would be very dangerous to use in a lamp, and even in the vicinity of a flame it might explode. It is thus clearly seen that gravity is no test. What, then, shall be the test?"

It appears to us that the apparatus Messrs. Smith and Jones suggest is open to a very serious objection, which can however be easily remedied. The construction of the instrument ensures the formation of an explosive mixture of Benzine and atmospheric air *within* the box holding the Petroleum. The flame used in testing for the presence of Benzine vapour would very probably in some instances travel down the space between the wick tube and the outer tube, and thus communicate at once with the explosive mixture immediately over the Petroleum, setting the latter on fire. The difficulty may be obviated by placing a piece of fine copper gauze through which flame will not travel at the top or bottom of the space between the wick tube and the outer casing. We submit this suggestion to the attention of Messrs. Smith and Jones, or else we should fear that their new "Benzine Detector" would in some instances become an "Explosive Naphthometer."

BRITISH PUBLICATIONS FOR JULY.

Abercrombie (John) Culture and Discipline of the Mind, and other Essays, n. e. f. 8vo	£0	3	6	*Edmonston & D*
Adams (E.) Elements of the English Language, 2nd edit., revised, post 8vo	0	4	6	*Bell & Daldy.*
Antrobus (E. C.) Rise and Progress of Painting, a History of Celebrated Painters, 8vo.	0	3	0	*Staunton.*
Aristotle's History of Animals. In ten books. Trans. by Richard Cresswell, post 8vo.	0	5	0	*Bohn.*
Badger, (George Percy) A Visit to the Suez Canal Works, 8vo.	0	2	6	*Smith & Elder.*
Bennett (Thos. R.) Popular Manual of the Constitutional History of England, cr. 8vo.	0	2	6	*Macmillan.*
Black's International Exhibition Guide to London, fcap. 8vo	0	4	6	*Black.*
Bradshaw's Illust. Exhib. Handbook to London and its Env., cor. roy. 16mo, 2s 6d sd	0	3	6	*Adams.*
Calabria and the Liparian Islands in 1860, by Elpis Melena, 8vo	0	10	6	*Saunders & O.*
Delamotte (F.) Book of Ornamental Alphabets, Ancient and Mediæval, 4th edit. obl.	0	4	0	*Spon.*
Dicksee (J. R.) School Perspective, 2nd edit. 8vo	0	5	0	*Virtue.*
Dodwell (Robert) Illustrated Handbook to the Electric Telegraph	0	1	0	*Lemaire.*
Dresser (C.) Development of Ornamental Art in the International Exh'n, fcap. 8vo	0	1	0	*Day & Son.*
Everybody's Pudding-Book, or Puddings, Tarts, &c., in their Season, 2nd ed. fcap. 8vo	0	2	6	*Bentley.*
Gleig's School Series. Hunter (Rev. John) Elements of Plane Trigonometry, 18mo.	0	1	0	*Longman.*
Guizot (F.) Embassy to the Court of St. James's in 1840, 8vo	0	14	0	*Bentley.*
Hewett (C.) Chocolate and Cocoa; Cocoa, its Growth, Culture, and Preparation, 12mo.	0	1	0	*Simpkin.*
History (The) of Progress in Great Britain, 3rd thousand, in 1 vol. 8vo	0	10	6	*Houlston.*
Horse (The), How to Choose Him and how to Use Him, new edition, fcap	0	1	0	*Ward & Lock.*
Huc (M.) Chinese Empire, cr. 8vo	0	5	0	*Griffin.*
International Exhibition of 1862: Official Illustrated Catalogue, Parts 1 to 6, imp., each	0	1	3	*Exhibition.*
—— Companion to the Official Catalogue, by R. Hunt, 12mo	0	0	6	*Stanford.*
—— Concise History of, by J. Hollingshead, imp.	0	3	0	*Exhibition.*
—— Official Catalogue of the Industrial Department, 8vo.	0	1	0	*Exhibition.*
—— Routledge's Guide to the, ed. by G. F. Pardon, cr. 8vo	0	1	0	*Routledge.*
Lankester (E.) Uses of Anim. in rel. to the Ind. of Man. 2nd Course, cr. 8vo. 1s 6d c. 1 v.	0	3	0	*Hardwicke.*
Lowe (E. J.) Natural History of New and Rare Ferns, with coloured Illust., roy. 8vo.	1	0	0	*Groombridge.*
Lowres (J.) Companion to English Gram.; Guide to Analysis of Sentences, &c., 12mo.	0	2	6	*Longman.*
M'Coy (F.) Synopsis of Characters of Carboniferous Limest. Fossils of Ireland, roy. 4to	1	5	0	*Williams & N.*
—— the Silurian Fossils of Ireland, roy. 4to	0	7	6	*Williams & N.*
Marriott (T. L.) and Glover (G.) Gas Consumers' Manual, 3rd ed., c. 8vo	0	2	6	*Kelly & Co.*
Mason (Rev. F.) Burmah, its People and Natural Productions, 8vo	0	10	0	*Trübner.*
—— (Rev. G. H.) Zululand, a Mission Tour in South Africa, cr. 8vo	0	3	6	*Nisbet.*
Peter Parley's Universal History on the Basis of Geography, 8th edit., 16mo	0	5	0	*Tegg.*
Piesse (G. W. S.) Art of Perfum'y, and Meth's of obt'ng the Odours of Plts., 3 ed. s 8vo	0	10	6	*Longman.*
Saxby (S.M) Study of Steam and the Marine Engine for Young Sea Officers, &c., p. 8vo.	0	5	6	*Longman.*
Scherzer (Dr. K.) Narrative of the Circumnavigation of the Globe in 1857–9, V. 2, r. 8vo	1	10	0	*Saunders & O.*
Scoffern (John) Handy Book of the Chemistry of Schools, cr. 8vo	0	4	6	*Bell & Daldy.*
Sewell (E. M.) Ancient History of Egypt, Assyria, and Babylon, fcap. 8vo	0	6	0	*Logman.*
Smalley (G. R.) Compendium of Facts and Formulæ in Pure Mathematics, fcap. 8vo.	0	3	6	*Bell & Daldy.*
Stubbs (G.) Illustrated Lecture on Sketching from Nature, with plates, fol.	1	1	0	*Day & Son.*

AMERICAN PUBLICATIONS FOR JUNE.

Emerson & Flint's Manual of Agriculture, for the School, Farm, and Fireside, 12mo.	$0 75	*Swan & Co.*
Fetridge's Hand-Book for Travellers in Europe and the East, with a Map embracing Colored Routes of Travel, 12mo	2 75	*Harper & Bros.*
Phin's Open-Air Grape Culture: a Practical Treatise on the Garden and Vineyard Culture of the Vine, and the Manufacture of Domestic Wine, 12mo	1 00	*C. M. Saxton.*
Spencer.—Education; Intellectual, Moral and Physical, 12mo	1 00	*Appleton & Co.*
Tafel's Investigation into the Laws of English Orthography and Pronunciation, 8vo p.	1 00	*Westerman & Co*
Trollope's North America, 12mo	0 60	*Harper & Bros.*

Selected Articles.

A COURSE OF SIX LECTURES

On some of the Chemical Arts, with Reference to their progress between the Two Great Exhibitions of 1861 *and* 1862, *by Dr.* Lyon Playfair, *C. B. F. R. S., Professor of Chemistry in the University of Edinburgh.*

Lecture I.

Distillation of Coal; especially in its Relation to the Production of Gas and to the Formation of Paraffine.

Ladies and Gentlemen,—In ancient Jewish times, the son of Sirach, in Ecclesiasticus xxxix. 26, has the following passage:—"The principal things for the whole use of a man's life are water, fire, iron, and salt, flower of wheat, honey, milk, and the blood of the grape, oil, and clothing." If it were not that chemistry has advanced so much in recent years that this definition of the son of Sirach no longer represents the comforts and enjoyments requisite for our advanced civilization, I would show you that each of these substances, either in their actual production or their improvements, depend upon the chemical arts; but it is the very progress of chemistry which has rendered this definition of little significance to us at the present time. No science has done so much as chemistry for penetrating into the secrets of nature and discovering those applications in the arts which are so necessary for our daily comforts. It would be impossible for me to attempt in a course

of six lectures to go over the range of the chemical arts. All that I can do is to take a few selected examples, and to refer to those chiefly with a view of showing you their progress between the Exhibition of 1851 and the Exhibition of the present year. But it would be contrary to the usual habits of this Institution, were I to confine myself simply to an explanation of the progress of these arts, for I cannot assume that the audience whom I have the honour to address are perfectly familiar with the arts themselves, and, therefore, can be interested by a mere account of their progress. I therefore propose, with your permission, to describe to you, generally, the nature of these arts in a popular manner, and then to refer to the discoveries which have recently taken place with regard to them.

When we examine the application of science to industry, we find that these applications benefit industry generally in one of three ways—first, by adding to human power, either by furnishing substitutes for brute labour, or by affording tools and methods for results formerly difficult or impossible, as, for example, when we use gunpowder in blasting rocks, and in the course of a few minutes can perform what would require ages of brute labour. It very often happens in this application of science to diminishing the efforts of brute labour that natural forces are employed, as, for instance, when Hercules was obliged to clean out the Augean stables, not by using a pitchfork, but by turning the waters of the Alphæus into it and sweeping it out by the use of this natural force. The second method in which science benefits industry is by producing economy in the time necessary to attain the result. Historians record as an example of wonderful dispatch the feat of Sir Robert Carey, who rode from London to Edinburgh to tell James the First that he was the King of England by the death of Elizabeth, and who occupied, in his weary ride, from Thursday to Saturday night. By means of the electric telegraph we can now despatch a message to the northern capital in much less time than the groom of Sir Robert Carey could have saddled his horse. The third advantage which science renders to industry is in the economy of material. There is nothing so characteristic of chemical improvement as the uses which it makes of waste products. A philosopher justly defined dirt as being merely matter in a wrong place. Put it in the right place, and it becomes a utility. The substances apparently the most worthless today, are even elegant utilities to-morrow. For instance, the parings of horses' hoofs, the horns of cattle, and cast-off woollen garments of the inhabitants of the sister isle, are mixed with scraps of old iron, and grace the dress of the courtly dames who wear dresses dyed with Prussian blue. All these substances when properly applied become important utilities. In all the manufactures to which I shall have to draw your attention in this short course of lectures, you will find that one or other of these three forms of benefitting industry is very apparent, sometimes appearing altogether, sometimes offering only one of the advantages.

I select to-day the manufacture of gas, not that that manufacture has made any decided progress during the last ten years as a chemical art—it has made very little progress—but its economy is better understood, and its science is also better comprehended. But I select it because I shall show you in the next lecture that the materials which were extremely waste and noxious in the manufacture of gas have all been utilised—at least, most of them have already been utilised; a few of them remain still to be utilised—and that they have produced important, common, and even elegant utilities. I therefore, commence to-day by giving you an exposition of the manufacture of gas.

No great discovery in the industrial arts starts into the world without giving abundant indications of its approach. There is no such thing as an industrial invention starting up full grown and panoplied in armour as Minerva did from the brain of Jupiter: it creeps into the world by slow degrees and by many indications foretells that it is approaching. So with the manufacture of gas. The Persians, ages since, saw gases coming through the soil; they set fire to them and worshipped them as holy fire. In our own country gases constantly came from the coal measures below the surface of the earth; and Shirley describes, in 1659, how he obtained these gases and set fire to them, and how illuminating they were. Sir James Lowther, in 1733, actually took the gases coming from the coal measures and conducted them away by pipes, and he burnt them at the surface and showed that they were combustible and highly illuminative. Clayton, the Dean of Kildare, in 1739, distilled coal in a retort, and he got what he calls "a phlegm, a black oil, and an incondensible spirit," This spirit is what we now know as gas. He could not in any way condense this spirit, so he collected it in bladders, and he pricked holes in the bladders and lighted the issuing gas for the amusement of his friends, Lord Dundonald did nearly the same thing on a much larger scale in 1786; but it was Murdoch, in 1792, who gathered up these isolated threads of science and spun them into a rope capable of supporting an industry. He showed how the knowledge previously acquired might be applied in the preparation of gas, and how that gas might be used for the pupose of illumination. It was not, however, till 1812 that this industrial art took root in London, and then so little was known about it that it is recorded that a lady of fashion, seeing a brilliant gas-lamp burning at Ackerman's shop in the Strand, insisted upon taking it away, light and all, in her carriage. It was no wonder that at that time gas did not become very popular; it was extremely bad; it had a nasty fetid odour resembling that of rotten eggs; it produced intolerable smoke when burning; it discoloured cottons, from the sulphurous acid which was formed in its combustion; it eat off the backs of books, and it produced languor and headache. Luckily it had advocate in Winsor, who thought that all these defects were advantages, and who inspired the public with his own enthusiasm, and who gradually extended the art in spite of these disadvantages; but what was much more important, it had a man of science in Clegg, who admitted the defects, and immediately applied his great skill to remove them; and it is owing to the great labours of Clegg in improving the manufacture of gas that we possess its excellence at the present day.

I need scarcely demand your attention to this as an important subject, because it must be quite

obvious to what an enormous advance civilization took when the coal gas became cheap and common. It has improved morality and lessened crime, by making every passer-by in the street a detective policeman. The art of street lighting was discovered as early as the fourth century, when Antioch was lit up by oil-lamps; and even at that time—as early as the fourth century—the art of street-lighting showed its advantages by ending unseemly brawls. We read at that time of a controversy between a Luciferan and an Orthodox, which continued in the midst of a crowd of people until the lamps were lit, when the disputants spat in each other's faces and retired. From the fourth century up to the fifteenth, or, perhaps, the sixteenth century, the art of street-lighting seems to have been lost; and it was only in the sixteenth century that streets began again to be lighted by oil-lamps. Now we have from thirty to forty thousand of these street lamps in London alone.

I now ask your attention a little to the chemistry of coal gas.

Coal gas is obtained by the distillation of common coal, or by the distillation of coals highly bituminous, as they are called—that is, which give out bituminous products in their distillation. Coal consists of carbon and hydrogen largely, of oxygen and nitrogen in smaller quantity, of sulphur a slight quantity also, and of incombustible matter and ashes.

When the coal is heated in a close vessel—that is, when they are distilled—at first the oxygen contained in that coal acts just as the oxygen that is in that fire: it burns some of the constituents of the coal. It unites with the hydrogen of the coal and forms water. Just as the oxygen there [referring to a small portable furnace burning on the lecture table] unites with the hydrogen of the coal and produces water, so does it in the close retort. It unites also with part of the carbon and forms carbonic acid, as it does in the open fire-place. But soon the oxygen of the coal is exhausted, and then the hydrogen, which is in large quantity, divides itself partly between the carbon and produces the illuminating gases and the liquids which I shall afterwards describe, and which are called hydrocarbons; and the rest of the hydrogen goes to the nitrogen and forms ammonia, and this ammonia we shall afterwards have to deal with also.

We will now take a simple case, which is an exact model of the manufacture of coal gas on a large scale. I have here an arrangement which will take a little time to act, and therefore I set it going just now. We have put coal in that retort, and it is connected with a receiver here. You will find, after a short time, that a liquid, which consists partly of water and partly of tar, comes over into the condenser. Our large bottle there is the condenser which we employ for this purpose. It produces, first, gaseous products; second, crude coal oil, which is commonly known by the name of tar; and it produces also a watery portion which contains ammoniacal salts. To-day we have nothing to do with the crude coal oil, or with the watery portion: that will be the subject for the next lecture. All that I have to direct your attention to now are the gaseous products; and these are divided into three divisions. The first class of gaseous substances produced by the distillation of coal consists of hydrogen, carburetted hydrogen, and carbonic oxide; and these are classed as diluents, for a reason which you will presently see. Then there are, secondly, illuminants, which consist of olefiant gas, and two substances called propylene and butylene. And, thirdly, there are impurities which are also gaseous, which are carbonic acid, sulphuretted hydrogen, and nitrogen. We can readily show the differences in the nature of these gases. I have collected these gases in a separate state here. I first have got hydrogen, which is one of the substances classed as diluents; and I will take these different gases and show you that they have very different properties as regards the purpose of illumination. I can easily pass a little hydrogen through here, and then you will be able to see, when we get the draught sufficiently, the amount of light it is capable of affording. We will just allow a little gas to pass through before we ignite it. Now, you see there is very little illumination there; in fact, the little illumination which is produced there is derived from the dust and the material upon the burner. Now, we will take carbonic oxide, which is another of these gases, and you will find that there is very little illumination here too. In this case we are obliged to burn it without a burner. You see there we have produced only a blue flame, without much illumination. Now, I have got here some marsh gas, or carburetted hydrogen, and you will find that this, also, is not much of an illuminant. They are all classed there as diluents. I have now here olefiant gas, which is a strongly illuminating gas. You see there that olefiant gas is very illuminating. I have here common coal gas, and you will see the great differences between these different gases. You see that coal gas, which contains all these gases—diluents as well as illuminants—is not so illuminting as olefiant gas. In that way you can compare the value of these gases as they are placed on the table.

Now, when we examine what is the chemical nature of these gases, we soon get an explanation of the reason of their different illuminating values. The amount of carbon contained in olefiant gas is 86 per cent., the amount of carbon in carburetted hydrogen is 75 per cent., and the amount of carbon in carbonic oxide, which burns with that blue flame, is only 43 per cent, Therefore, the illuminating properties of the gases are in proportion to the amount of carbon which they contain. I think that I can show you this by a simple experiment. I have here hydrogen—a gas which I showed you before. You have seen that it burns with very little flame. I should tell you that the reason that it produces very little flame, is that it produces a gaseous substance in burning. In the act of burning it forms water. Now, gases require a very high temperature before they are luminous, and the products of the combustion of hydrogen is steam; and that product requires such a high temperature to become luminous, that hydrogen is only faintly so. But solids, on the other hand, become luminous in the dark at 700 degrees, and brightly so in daylight at from 1000 to 2000 degrees. Now, I want you to understand the nature of the experiment I am going to make, before I put it in operation. I have here hydrogen burning as you saw before, and producing simply steam, and therefore

not producing much light, because that product is gaseous. I will now turn that off, and I will produce the combustion in this tube with peroxide of barium. The peroxide of barium will supply the flame with oxygen, and form water exactly as is produced when the gas is burning in the open air; but at the same time, during the act of formation of this water by the oxygen of the peroxide of barium, there is a solid to be heated to redness. We will now heat the peroxide of barium. I have wrapped it up in talc. You see now that water is being produced, and gradually as the heat gets up you will see that the action will become much more perceptible. This tube is rather too small for me to apply as much heat as I desire. The water is now being formed in the presence of a solid. What a brilliant amount of light the gas gives out on account of the solid being at the same time heated to redness. You see, therefore, that when we form exactly the same product under the conditions under which a solid becomes heated, a large amount of illumination takes place. I want to show you that in another way, and in a very instructive way. I have here a means of passing hydrogen through this row of bottles. I now can pass hydrogen through these various vessels, which contain various volatile liquids. Now, this hydrogen will, on its passage through the liquids, suck up portions of these various preparations, and we shall charge the gas with solid matter, and in this way obtain an illuminant. The liquids through which it passes are chlorochromic acid, chloride of antimony, and benzole. The first two will give solid oxides to be heated to redness; the latter will give solid carbon, and the hydrogen in all cases becomes illuminating. Unfortunately, however, I cannot continue this instructive experiment, for some air has entered into the bottle since the commencement of the lecture, and produced an explosive atmosphere.

The fact which I want you to notice is that there are illuminants in coal gas, which are illuminants because they contain so much carbon—that in proportion to that carbon they are illuminating; that as that carbon is small in quantity, they are merely diluents, and dilute the gas without in any way illuminating it.

And now I must explain to you what is the action of these diluents. These diluents which are described on the diagram, and which you have seen, are the oxygen, and the carbonic oxide. Their object is to sweep the gas out of the retort, and prevent the illuminating gases being decomposed by the heat. In distillation a large quantity of the illuminating gases is being produced, but they may be decomposed by the red-hot vessel; and unless there were those diluents formed at the same time to sweep out these illuminating gases, it would be impossible for the gas to preserve the highest quality.

I will now, before we go into any further experiments, describe to you the general conditions of the coal manufacture. First, we have to try to get a large amount of illuminating ingredients mixed with enough diluents to protect them in their formation, and to enable them to be burnt without smoke and without smell; and second, we have to try and remove the noxious gases and impurities.

The first condition or process in the manufacture is distillation. For this purpose there are certain retorts which are represented on that first diagram. These retorts may be made of iron, as in our experiment, or they may be made of earthenware as they are represented in the diagram In these retorts is placed coal, which varies in amount from 12 cwt. to one ton, according to the size of the retorts. The fire overlaps the retorts, as it is doing in this case of the gas manufacture which is now going on as experimentally, and heats the coal gradually. The substances which are formed are partly tar, which comes over as the tar is now coming over into this condenser, partly water, and partly the gas which is also going over. If you follow these retorts you will see that there are certain stand-pipes. These stand-pipes conduct the gas up into what is called the hydraulic main. The stand-pipes are generally about five inches in diameter, and dip into a large cylinder or pipe, which is fifteen or sixteen inches in diameter. There is a curving over as you observe, so that the pipe dips into tar water, which condenses in this hydraulic main. By this arrangement the ends of the pipe are sealed up by the water in the main, but can bubble through it. The gas comes over here, and the surplus tar passes over into what is called the tar-well by means of this small pipe which conducts away the tar and water into the tar-well. And now the gases, having come out of the retorts, pass through the series of pipes which are represented in the next diagram. The object of those pipes is to cool the gases. They expose a large surface to the cooling influence of the atmosphere. Sometimes water is poured on them, but usually they are merely exposed to the air. This condenses the coal-tar and water which the gas still retains in suspension. Now, the gases pass after that through what is termed an exhauster. The use of the exhauster is this—that in passing through that system of pipes a considerable friction is caused, and that friction would retard the flow of the products were it not that this exhauster is used, which prevents the friction keeping the gas back into the retorts. If the gas were retained for any time in the retorts, the heat would decompose the illuminating gases and convert them into diluents, and, therefore, this exhauster is employed. After passing through the exhauster, the gas traverses what is termed the scrubber. This scrubber is merely a large cylinder filled with coke, which is sometimes dry and sometimes has a quantity of water passing over it. This washes the gas and removes many of the impurities from it. It acts mechanically also, by taking away the tar and removing it from the gas. The gas having passed through the scrubber, it now goes through a very important piece of apparatus which is termed the purifier, and which I must now show you here. You see here a vessel containing different shelves. These shelves are covered with lime, and the lime has the power of absorbing two of the constituents of the gas, which are very injurious: first, the carbonic acid; and secondly, the sulphuretted hydrogen, both of which are serious impurities. The milk of lime, or lime, which is employed for this purpose takes away the sulphuretted hydrogen, which in itself has a bad smell, and which, in its combustion, produces sulphurous acid and decolourises drapery and other matters when it comes in contact with them; and the lime also removes the carbonic acid which, even when present to the

amount of only one per cent., diminishes the illuminating value of the gas six per cent. But the ammonia is not removed by this operation.

In recent years, another plan has been employed for purifying gas, and it is to this I would like to draw your attention. The new process consists of passing the gas through a mixture of sawdust and iron. The oxide of iron takes away the sulphuretted hydrogen by producing water and forming sulphide of iron ; and after it has acted for some time, the passage of air through the mixture restores the sulphide to the state of oxide depositing sulphur, so that the purifying agent can be repeatedly used till its pores get choked with sulphur.

I have here the means of showing you how completely this plan of oxide of iron mixed with sawdust purifies the gas ; and it is this which, not entirely, but to a great extent, is employed to the exclusion of the lime purification. I have here a bent tube containing oxide of iron and sawdust. The coal gas which I turn on is forced to pass through a saturated solution of sulphuretted hydrogen, so as to become fully charged with that noxious gas. I first allow the gas to pass, not through the iron, but at once through a solution which I have here as a test for sulphuretted hydrogen. In this solution I have a little nitro-prusside of sodium, which is an extremely delicate test for sulphuretted hydrogen—so delicate, that if I were to take a lock of lady's hair, dissolve it in an alkali, and put it into this liquid, it would immediately assume a purple colour. You see [after passing the unpurified gas into the test water] the solution has now become of a purple colour, showing the presence of sulphuretted hydrogen abundantly in the gas which we are employing. Now, having shown you that, I will turn this off and pass the gas through the oxide of iron and sawdust intervening ; and you will observe that, at all events for a considerable time, it will pass through the solution and produce very little coloration. It has produced a trace. We are passing it too quickly, The least quantity does it, but, you see, not nearly so rapidly as before the gas passed through the purifying mixture. The smallest quantity—the most minute trace passing will produce the coloration, but you notice that scarcely a sensible coloration is produced, and we get nothing at all like this effect [referring to the coloration caused by the unpurified gas] ; so that the oxide of iron has the power of taking out the sulphuretted hydrogen, and producing sulphuret of iron, and relieving the gas from the presence of this noxious ingredient. There is another substance, however, present as an impurity which this process does not remove ; it does not remove the bisulphide of carbon, or the compound of carbon and sulphur, which is always present in gas. The bisulphide of carbon, CS_2, which is present in coal gas, has lately been removed by passing it over heated lime ; the water of the lime is decomposed, and sulphuretted hydrogen and carbonic oxide produced ; and then this sulphuretted hydrogen can be removed by the ordinary lime-purifier in the manner which is shown in this experiment. Dr. Smith has, within the last few weeks, introduced a second plan for removing the carburetted hydrogen by passing the gas through a solution of oxide of lead in sawdust. I need not follow the gas through the various other mechanical contrivances for collecting it and distributing it through towns. After the gas is purified it then passes through the gas-meter, where it is measured, into the gas-holder from which it is distributed to towns. There is an ingenious arrangement here, which is interesting. The diagram shows a gas governor or register which regulates the quantity of gas which is to be given out at various times during the day. If you look at that little diagram in the centre, you will see that the amount of gas used varies according to the time of day. During the day it is almost a dead level ; about nine o'clock, at this time of the year, the gas begins to be lighted, and you see how rapidly it goes up till about eleven o'clock ; people go to bed about that time, and then it as rapidly descends till about day-break, when it goes up a little further. Now, the plug by rising and falling determines the amount of gas which shall be given out during the different hours, and according as it is lowered in the tube, or is allowed to ascend, so the quantity of gas escaping into the town is regulated.

I want you now, for a moment, to consider what is the chemistry of the ordinary candle, not that I am going to do what has been so often and so successfully done here by Dr. Faraday, but I propose merely to draw your attention to a very important discovery in the manufacture of candles, which has been introduced within recent years. If candles had followed instead of preceded gas manufacture it would have been said that they were the greatest discovery of modern times. A properly constructed candle is merely a portable gas-works, requiring not costly or complicated apparatus ; it is a means by which a very pure gas is produced little by little, as we desire to burn it, and in this respect forms an interesting illustration of the subject I have brought before you.

Candles and lamps differ only by one being fed with a liquid oil, the other having an oil liquefied for it as is desired. The heat of the candle liquefies a certain portion of oil which is drawn up by the wick, and is there converted into a gas, and is burned. The earliest candles that were introduced were, no doubt, torches. We read of Ceres instituting the search for her daughter Proserpine by the light of two burning pines, which were merely a rude substitute for our modern invention. The history of the candle is tempting, but I cannot enter upon it. I would simply draw your attention to this diagram, by which you will see the manner in which it acts as a portable gas-works. Here I have a diagram of the candle. This represents the liquefied fat which is drawn up into the pores of this carbonised wick, which you must consider as so many small gas-retorts. The fat or the wax is constantly distilled, and forms the gas which burns in the ordinary flame of the candle, the gas being produced as it is required, and needing no purification. If it were possible to take the most illuminating ingredient of coal gas, which is olefiant gas,—that ingredient which contains 85 per cent. of carbon,—if it were possible to take that illuminating ingredient and to condense it into a solid, we should have the highest conditions for the manufacture of coal-gas. Liebig, as early as 1841, said in one of his letters that it would certainly be esteemed one of the greatest discoveries of the age if any one should succeed in condensing coal gas

into a white, dry, odourless substance, portable, and capable of being placed upon a candlestick or burned in a lamp. This was in 1841. In 1851, at the Exhibition, Mr. Young exhibited a substance termed "paraffin," that had formerly been made from peat, or from the distillation of wood in small quantities, and he exhibited a single candle made from it. Now, this paraffin is nothing but olefiant gas in a solid form, that is to say, it is isomeric: it is of the same composition exactly as olefiant gas, and is simply olefiant gas, if you will allow the "bull," in a solid state. When coal is distilled at a lower temperature than that necessary to form gas, there first comes over an oil, which contains in solution a solid. This oil itself is called paraffin oil, it is in reality of the same composition as olefiant gas, that most illuminating gas which I showed you. When it is cooled it deposits a solid substance known as paraffin. Now, it is very interesting to observe that all these three are the same in composition. This oil is liquid olefine, the solid body is also an olefine, and is termed paraffin. The ordinary olefiant gas, which gives an illuminating character to our coal gas, is the same substance in a gaseous state; or, rather, is not the same substance, but a substance of the same composition. In 1851 I was so struck with the one candle that was exhibited in the Exhibition that I gave one of the Friday evening lectures here upon the subject, and stated that it was probably the germ of an industry which would become a very important one. It has now grown so large that the Bathgate Chemical Works, for the manufacture of paraffin and paraffin oil, rank among the largest chemical works in the world. If you will go now to the Exhibition of 1862 you will see enormous blocks of this solid wax produced from coal. Here is the coal from which it is derived—the bog-head coal: it certainly does not look much like coal, and has promoted great discussion as to whether it is a coal or a schist. This bog head coal, and other coals, when slowly distilled, produces an oil, from which this beautiful solid wax called paraffin is prepared. It is, as I have explained, of the same composition as olefiant gas, and from it are now produced those beautiful wax candles which we ordinarily burn, and which are the perfection of the manufacture of coal gas, because each of these contains the illuminating material of coal gas in a condensed and solid form, so that when the candle is burned little by little, this olefine is changed from its solid state to its gaseous state, and is consumed. This paraffin is a beautiful wax, melting at 120 or 130 degrees; it produces a beautiful white light, on account, in fact, of producing the true olefiant gas. The oil also has the same qualities. You observe it burning here, and you must distinguish this from what are termed the paraffin oils which are now ordinarily sold in commerce, and which come from Canada and other parts; they contain various volatile bodies which take fire at ordinary temperatures, and which are extremely dangerous; they may be as dangerous as camphine or benzole on the application of a light. Paraffin oil made from coal does not burn at ordinary temperatures, it only burns in the presence of a wick, and is perfectly safe, carrying up, by the slow capillary attraction of the wick, a certain quantity of the oil in contact with the heated surface,—olefiant gas being thus gradually produced, so that you have the true perfection of an illuminating gas formed in the lamp.

In the next lecture I propose to follow out that tar and water which are now in the condenser, and to show you what beautiful utilities they have been converted into; we shall take the ammoniacal salts produced from the water, and the beautiful coal-tar colours which are formed from the tar.

AN ARTIFICIAL SUBSTITUTE FOR INDIA RUBBER AND GUTTA PERCHA.

BY S. WALTON.*

Numberless attempts have been made to produce a material possessing the qualities of India-rubber, and this material, together with gutta-percha, has been distorted into all forms, and has been compounded, in a most heterogenous manner, by a host of experimentalists seeking to produce a cheaper material, but no valuable results have been arrived at. The cheapest base for experiment had, I humbly submit, been neglected. It is well known that linseed nut and poppy oils possess that nature, which distinguishes them from lubricating oils, of becoming concrete on exposure to the atmosphere; that is, that when spread in a thin layer on a surface of wood or iron, they dry or change into a thin skin. This change which is erroneously called drying, is produced by the absorption of oxygen and the disengagement of carbonic acid, and is, in reality, only a change of their elementary constitution.

This property of absorbing oxygen rapidly is not considerable in the crude or raw linseed oil, but it is very greatly increased by boiling the oil, that is, exposing a large quantity of raw oil to a strong heat in a cauldron, with a small per centage of metallic oxide of lead added. It is then called "varnish," and has a more viscid character, and is also rather more highly coloured. A layer of this oil requires from 6 to 24 hours to dry or change into a skin-like substance, according as the state of the atmosphere is more or less favourable.

I cannot do better than give to you a detailed account of the circumstances which combined to bring this subject before my notice. Whilst engaged, about two years ago, in a series of experiments on the manufacture of artificial leather, it was of the greatest importance to the success of the material that it should have a coat of fine varnish, which, whilst drying quickly, possessed the flexibility of India rubber. Copal varnish has always been accounted the best varnish, but made with drying oil combined with gum copal at a high temperature, it will not, of course, be dry until the action of oxidation has reduced the oil contained therein into a solid film. Whilst revolving in my mind this knotty difficulty, and presenting every phase of it to careful thought, it suddenly occurred to me that if the oil was first dried into a skin, like those I had often seen on paint cans, but, like other people, had before considered as waste, was dissolved in a volatile solvent, like India rubber sheet—that the semi-resinous material would immediately on the evaporation of the solvent, resume, like India rubber, the form it was in prior to solution. By dipping panes of glass into linseed oil, and allowing the films or layers to dry, then re-

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peating the process, I imitated the manufacture of India rubber from the milk, and thereby produced a solid elastic substance, composed of many layers of perfectly oxidised oil. Up to this stage I had done nothing new or original, for the oil sheet manufacturers have for more than a century waterproofed linen by layers of oil. But to treat this semi-resinous matter and render it available to purposes of manufacture, will be admitted to be perfectly new, and I now proceed to describe the invention. Having accumulated a quantity of solid oxidised oil by drying it upon extensive surfaces of any kind, such as prepared cloth, stretched in frames, as described in my patent of the 27th January, 1860, I then scraped or peeled it off by suitable means.

At first, as before stated, my attention was solely directed to the attainment of a speedily-drying, flexible varnish at a moderate temperature, but very few experiments with this oxidised oil led me to notice its rubber-like qualities, which I at once conceived might, with further manipulation, and with some combinations, be developed more fully, and become a very valuable substitute for that article.

Encouraged by success at every step, I proceeded, and soon found that by crushing the solid oxidised oil obtained in sheets as described in my patent, and working it thoroughly in hot mixing rolls, I produced a substance which required only the cohesive nature, which in the early part of this paper we noticed as existing so strongly in India rubber. The addition of a small proportion of shellac soon gave that which was wanting, and I found in my power a material singularly like caoutchouc when worked into dough, and which could be rolled on to fabrics in the same manner and with the same facilty—giving a perfect waterproof cloth, unlike oil cloth, but having the rubber finish and flexibility. Pigments could easily be added to give colour; the addition of resins gave other, or rather varied proportions of adhesion, useful as affording the means of uniting fabrics as by rubber. Fibre, whether flock or cork, mixed in and rolled into sheets, gave me samples of kamptulicon and other floor cloths.

These experiments were made more than two years since, and some of my earliest samples are now on the table before you—together with many of more recent date which I have yet to refer to; and besides them you have similar productions in rubber, which will enable you to make a comparison. Although I had thus accomplished more than my first anticipations, my primary object was yet unrealized, and I had, day by day, proofs of how entirely I was dealing with a substance of which the characteristics were entirely unknown to us. Various were the solvents tried to dissolve it. Obtained from oil it was unaffected by oil; no longer did it retain any unctuous matter, one of the greatest proofs practically of which is, that whilst any oil or greasy matter will destroy India-rubber very speedily, yet they have no effect on this; the two may be well combined. For a long time was I baffled in every attempt to find a solvent. Any heat short of carbonising it had no effect on the material, and here was evident a great advantage over rubber for practical purposes, if other desiderata were accomplished. At length I was able to dissolve this converted oil in alcohol and wood spirit—thus did I obtain the first varnish. Sufficient success had thus attended my labours to justify, at any rate in my own, perhaps sanguine mind, my patenting the discovery in England, France, Belgium, and America, and taking and fitting up works for the production of the material. But yet much remained to be achieved; the process was slow, the solvents were expensive, and did not offer all that was desired in the way of varnish. It was also desirable to obtain a medium state answering to the India rubber cement or dough capable of being worked by the guage-spreader which I have this evening described to you, and in which it would dry as rapidly, that is, within a few minutes of its passing the machine, this last requisition creating no small part of the difficulty. Some months more of diligent experiment led to more definite results, and at length I was enabled, by experiments which involved much time and labour, to perfect the solution in the distillates of coal, preferring the usual rubber solvent, naphtha. Thus was the material brought still further into a state so nearly resembling rubber solution or cement, that even those most accustomed to the manufacture thereof could not distinguish one from the other, and in all respects it could be treated in the same way. Samples of the varnish, of the cement, and of the dough, I have also the pleasure to present to your notice. I would here remark that the success of this discovery is mainly due to the perseverance of my partner, Mr. Richard Beard, junr., who, with the same energy he devotes to the business department of our works, more especially under his care, has rendered me great assistance in these and later experiments.

Not only has this singular product been thus assimilated to rubber for uses on fabrics, or combined with fibre for floor cloths, but still more strange, it is capable of being worked with pigment and vulcanised exactly as India rubber has been described to be, and forms a hard compound like vulcanite and ebonite, excepting that the sulphur is not necessary. Pieces thus hardened are also placed on the table before you.

Having now explained the means of obtaining, treating, and applying this oxidised oil—its wonderful similarity to rubber must, I think be apparent to all. I then submit that the process of solidification of the oil is identical with the drying and solidification of the rubber on the clay moulds I have in this paper referred to, with this difference, that with the rubber it is an evaporation of the fluid which holds the particles in suspension, in order that they may coalesce, and thus, of course, there is a loss of weight, whereas with the oil there is an increase of weight (ascertained by accurate experiments) from the absorption of oxygen. Chevreul confirms this point in his researches on oil painting.

The applications of my prepared oxydised oil are not limited to its uses as a substitute for rubber, as will be seen by the following list, but before passing on to its other applications, we will notice its advantages over rubber. 1st. The great difference in price which must ever exist from the facility with which one can be produced in the natural state over the other, for abundant as are the various trees yielding caoutchouc, the difficulty

of collection, and scarcity of labour in regard to quantity obtained, must always keep up the price of natural rubber, whilst the linseed from which the oil is obtained can be so easily and cheaply cultivated.

2nd. That being unaffected by oil or grease it is more durable than rubber in many of its applications, especially where used in various manufactures, such as cards for carding wool, printers' blankets, &c. That also for purposes where rubber is injured by temperature, this is unaffected. And last, though not least, its durability, inasmuch as it is free from those elements of decomposition which, it is admitted, are set in action by the very process that it is necessary for the rubber to undergo in course of manufacture, not to notice the numerous combinations therewith in use, in too many instances, on account of the high price of the pure material.

LIST OF APPLICATIONS.

Surface Fabrics —Clothing, carriage aprons, cart sheets, sail covers, bath sheets, nursing aprons, sponge bags, &c.

Imitation Leathers.—Carriage lining, chair covers, boot and shoe leathers, trunk covers, saddlery, bags, reticules, &c.

Common Surface Fabrics.—Packing cloths and papers, cart-sheeting, tarpauling, brattice cloths for collieries, &c.

Double Textures.—Clothing, mail bags, hospital sheeting, card cloths, printers' blankets, water and air beds, cushions, &c.

Manufacturing Purposes.—Packing for steam, water, and gas pipes, valves, machine banding, hose pipes, tubing for carrying beer, &c., flax-spinners' bosses, calendering and embossing bowls, cop tubes, telegraph supports, or insulators, tank linings, ship sheathing, roof coverings, shoe soles, &c.

Hard Compounds (of any colour).—Knife and fork handles, surgical instrument handles, surgical and dental appliances, tubing for chemical vessels, picture frames, trays, mouldings, furniture ornamentation, panelling, veneers to imitate marble, ivory, ebony, and other woods, &c.

Miscellaneous.—Washable felt carpets, kamptulicon (of any colour), stair coverings, toilet mats, table covers, &c.

Flexible quick-drying varnishes. Paints for carriages. Painting or printing floor cloth, table cloth, &c., (will dry in a few minutes) enamels of any colour, for enamelling papier maché, metals, &c.

We now pass to the advantages to be derived in the use of the material under consideration, for some of the purposes in the foregoing list, to which boiled oil has hitherto been applied; and first we notice the important article of leather cloth, commonly called American leather cloth. This is prepared by coating the fabric with oil boiled to a thick consistency, mixed with black pigment. This is spread on cotton fabrics, which is placed in a temperature of, say 120 to 150 degrees, for a day, to dry or oxidise the oil coating. For convenience of han ing, these are in twelve-yard lengths, and this operation has to be repeated for five or six successive days, according to the thickness of the coating required, and lastly, in the same manner, a coat of copal varnish is given, each of these requiring the same length of time to dry. Thus seven to eight days were requisite to prepare the cloth for the embossing rollers. By the use of oxidised oil, properly prepared, you have all the same qualities as are obtained by allowing the oil to oxidise on the surface of the cloth, avoiding the consumption of so much heat and time, as well as injury to the fabric itself—with the advantage of being able to spread each coat successively, the solvent evaporating as when used with rubber, while it passes through the machine, the length not being limited to twelve yards, and there remains only to apply a coat of varnish to increase the brightness of the surface. Thus in one day can be done, not only the work of seven, but a greater quantity by working increased lengths. For oil-dressed cart sheets, omnibus and other driving aprons, waterproof packing materials, and a host of other such purposes, this preparation is most suitable. And lastly, we have the important use as a varnish, either as such or to mix with pigment, as a paint. We all know the time requisite for ordinary paint to dry—this we equally well know is the time requisite to dry or rather oxidise the oil in the paint. The spirit, be it turpentine or other solvent, would quickly evaporate. The coats of paint on doors and walls are but coats of oxidised oil, c arged with pigment, as perfect and pliable skin as the coating of a fabric, if too much pigment has not been used. If then you complete the oxidation previously, and dissolve the oxidised oil so as to render it fit for application by the spreading machine of the manufacturer, or the paint brush of the painter, when the solvent evaporates, which it does very rapidly, you have a flexible, tough, waterproof coating, which will be dry enough for succeeding coats within half an hour.

In carriage painting, floor cloth manufacture, and kindred articles, months are now consumed, which might well be saved. The patterns of felt on the table are printed with colours thus prepared, and some pieces of wood, painted at the carriage factory of Messrs. Holmes, are also here.

I am conscious how imperfectly my task has this evening been accomplished, but I have shown you how analogous a substance this material is to the elastic gums. In conclusion, I beg to thank you for the kind attention you have given me, and must apologise for the many defects and deficiencies which exist in this paper. Many of them would, I flatter myself, have been obviated but for the disastrous fire which occurred at our works the week before last, at which time I was engaged in preparing these particulars, and this has prevented my carefully reviewing the sheets before submitting their contents to you. Such a fatality will, I am sure, be an adequate excuse, and this must also be given as a reason why so poor a display of samples is placed for your inspection, our stock having been entirely destroyed And I would add that, not being waterproofers ourselves, the samples are more roughly finished than would be the case if produced by more experienced hands.

We hope to have our works in order in about a month, and then we shall be most happy to demonstrate to any one interested, the applicability of this new material to the purposes specified.

APPLICATION OF ALUMINIUM TO PRACTICAL PURPOSES.

The constant appearance in our jeweller's shop of fancy articles of aluminium is beginning to draw very general attention to that valuable—but not admitted precious—metal. A few years ago (1855) small specimens were handed about and examined as curiosities from Deville, the French chemist's laboratory, with great interest. It is true it had been discovered eight and twenty years before (1827), by Professor Woehler, of Gottingen; but people then heard the announcement of the elimination of the metallic base of clay, with little more than that ordinary indifference with which the description of a merely new element is commonly received. Deville, whose name is everywhere familiar for his many valuable labours, however, in his investigations of its characters, found that it possessed peculiar and curious properties, and he unhesitatingly stated his impression that it was a metal destined to occupy an important position in the requirements of mankind, as soon as means could be found of obtaining it in manufacturable quantities.

In his first statements (1855) he drew attention to its power of resistance to all acids save hydrochloric, to its fusibility, its beautiful whitish-blue colour, and the fact of its undergoing no change of lustre or colour by the action of the atmosphere or of sulphuretted hydrogen. Its density as low as glass, he foresaw would insure many special applications, while superior to the common metals in respect to the innocuousness of its compounds with the feebler acids, and intermediate between them and the precious metals it was evidently a fitting material for domestic purposes. "And when it is further remembered," he added, then, "that aluminium exists in considerable proportions in all clays, amounting in some cases, to one-fourth of the weight of a very widely-diffused substance, one cannot do otherwise than hope that sooner or later this metal may find a place in the industrial arts."

This prevision seems to be realising itself every day, and a forcible proof of the rapid strides made in its economic production is afforded by a comparison of its past and present commercial prices. A few years ago it cost 60*l*. per lb., while from the Aluminium Works recently established at Newcastle, in our own country, it is now supplied at less than sixty shillings. Every step taken in the reduction of the prime cost of a raw material widens the range of its adaptability to ornamental purposes in the arts, or useful applications in the manufactures. It is malleable and ductile, being reducible to very thin sheets, or capable of being drawn into very thin threads. In tenacity, it is superior to silver, and in a state of purity it is as hard. It files readily, and is an excellent conductor of electricity, and combinations of it, with other metals, have already been used with advantage. The most important of these compounds is aluminium-bronze, formed of one part of aluminium with nine of copper. This bronze possesses great malleability and strength, Professor Gordon's experiments giving the following relations of wires of the same diameter: iron, 100; aluminium-bronze, 155; copper, 68. This immense tenacity and strength confer on this bronze admirable qualities for the working parts of machinery where great durability is required, and notwithstanding its higher price than that of ordinary metals, the quantity of aluminium required is so small, that it is said that practically the cost of the bronze does not exceed that of ordinary brass or gun-metal bearings.

Another property of aluminium is its extreme sonorousness, and this has also had very serviceable application in the construction of musical instruments. So highly sonorous is it, that a mere ingot suspended by a fine wire emits, when struck, a clear and ringing sound.

The metal can be beaten out into leaves for gilding, or rolled in the same way as gold or silver, and it can be drawn out into wire fine enough for the manufacture of lace. It is also easily run into metallic moulds, or, for complicated objects, into moulds of sand. It is very finely susceptible of what is technically called "matting," by being plunged into a weak solution of caustic soda, and then exposed to the action of nitric acid. It is also easily polished or burnished by a polishing stone steeped in a mixture of rum and olive oil. When aluminium is soiled by greasy matters it can readily be cleaned with benzine. Soiled by dust only, india-rubber or very weak soap and water may be used.

The process of soldering aluminium also is worthy of note. The solder used is composed of zinc, copper, and aluminium, and the pieces of the article intended to be joined must be "tinned," as in ordinary soldering with tin, with the aluminium-solder itself. The pieces are then exposed to a gas blow-pipe or other flame; but in order to unite the solderings, small tools of the metal itself must be used. Tools of copper or brass, such as are employed in soldering gold and silver, are not permissible, as they would form coloured alloys; moreover, no flux whatever can be used, as all the known substances employed for that purpose attack the metal, and prevent the adhesion of the pieces. The use of the little tools of the aluminium is an art which the workman must acquire by practice, as at the moment of fusion the solderings must have friction applied, the melting taken place suddenly and completely.

In comparing the price by weight of this with other metals, its greater bulk must be borne in mind. Thus comparing it with silver, the bulk of a given weight of aluminium is nearly four times that of the same weight of silver, so that if one ounce of silver were required for an article, four similar articles could be made of one ounce of aluminium. Its lightness is, as we have before observed, one of its principal qualities; the specific gravity of platinum is 21·5, of gold 19·5, tin 7·3, while that of aluminum is only 2·6. The lightness which it communicates to the bronze, whose durability, hardness, and immense strength nearly equal that of the best steel, renders probable its future extensive use in the construction of buildings, the manufacture of ordnance, and other objects where strength and lightness are required to be combined.

Having witnessed how admirably the French have applied this metal to ornamental and fanciful objects, it will be a matter of future interest to watch the developments of its applications, as a British manufacture, to more solid and practical objects.*—*London Review.*

* A very interesting paper on Aluminium, by Mr. P. Le Neve Foster, will be found in the Society of Arts Journal, vol. vii, p. 162.

COLOURED MATERIALS,

CONSIDERED WITH REFERENCE TO THEIR APPLICATION TO INTERNAL DESIGN.

BY J. JOHNSON, ESQ.*

The use of Colour for internal decoration is universally recognized. No apartment is considered complete without it. Form is not sufficient in itself, and painting is the means usually employed to give effect, and render apartments pleasing and satisfactory to the eye. There are many other ways, however, by which variety is obtained for internal decoration. Plastering, papering, and furniture, all add to and increase the effect. These are resources at every one's command, and can be altered or varied according to the taste of individuals.

Then there are imitations of natural materials or inferior substances often introduced very skilfully in the representation of the most beautiful woods, marbles, &c., in every variety. Many writers have condemned this mode of finishing as false and inadmissible, where *truth* is to be regarded in building as in other things. It is difficult, however, to carry into practice many of the theories put forward, even though the arguments in favour of these theories seem plausible, and at the same time almost conclusive. For my part, I admire and respect this manifestation of truth in Building. I should be glad to see it universally adhered to; and I wish that the desire to obtain so much for money was less universal: we might then hope that our ornamentation would be more genuine than it now is. I fear, however, that this will never be entirely accomplished. We have now become so accustomed to admire what is false of a superior order for the sake of ornament, in preference to that which is genuine of an inferior order, that we shall never be able to do without veneering, graining, and the various other imitations of the present day, in some degree.

When anything becomes general, and is understood only as imitation, it is said to be no deception. It is said that the gilding of wood or other material is quite legitimate, because it is no longer understood to mean that the whole substance is gold, but that the gold is only a film put upon some other substance for the sake of giving a more brilliant finish. It must be remembered that this film or outer coat of gold is genuine.

If this species of ornamentation be allowable in one material, although that be very costly, it seems to me that it is pardonable in any other so long as it is understood. For this reason we must admit veneering to be legitimate, and in many instances stucco and cement, if not graining.

When imitations are resorted to, there are three general conditions which, I think, should be observed. I quote them from a paper read at the Architectural Institute of Scotland by Mr. T. Purdie. They are:—

"1. That they be not employed when the material represented would of itself be out of place or inappropriate.

"2. That no object be painted in imitation of one material which, from its form, construction, or application, was obviously or necessarily composed of another.

"3. That no imitation be employed in positions where we are entitled to expect that the real material should be used, or where the discovery would create disappointment."

In connection with painting as applicable for internal decoration, the rules observed in the chromatic decoration of the New York Crystal Palace are the most concise and useful I have met with. They are:—

"1. Decoration to be subordinate to construction in all cases.

"2. Features of main construction to be of one prevailing tint.

"3. The prevailing colour of ceilings sky-blue, the monotony prevented by the introduction of orange (the natural complement of blue).

"4. Rich and brilliant tints, in small quantities, to be employed to attract the eye to the articulations and noble portions of the members, rather than to the members themselves.

"5. All natural beauty of colour existing in any material should, if possible, be brought into play by using that colour itself, instead of covering it with paint of another hue.

"6. All ornamentation to be consistent with the construction.

"7. White, in large quantities, in all cases of simple composition, not only to give value, by contrast to a few colours employed, but to reflect light and cheerfulness to the work."

Let us now consider how far the real materials (generally imitated only) may be introduced in ordinary designs, and how far materials of an inferior order may be made beautiful in themselves, without their being any necessity for covering with veneers or painted imitations.

I believe that there are beauties in many of the materials commonly used in the construction of buildings, which may be made to tell in the general design, and produce an equally pleasing and more truthful effect, if properly and carefully arranged, than by any amount of imitation; and when materials, although superior to others in their beauty, of themselves cannot be introduced on account of expense, those used do mostly possess sufficient beauty, and may be made to substitute them in design as well as construction.

When sufficient funds are allowed the Architect or Designer, there is not so much difficulty. There are abundant resources in nature. We find materials of almost every variety of colour and tint. Marble, stone, and wood are to be had in infinite variety; and when wrought into finished and polished surfaces are most beautiful, and far superior to any painted surface which the ingenuity of man can invent or the skill of the artist execute.

Colour is also made successfully to form a part of our Artificial Manufacture, as brick, tile, and the ceramic art generally.

We have recently seen some very successful applications of natural materials, both as to colour and form.

* From the *Universal Decorator*.

No one has, I think, visited the new Church of All Saints in Margaret street, without being struck with the extraordinary and beautiful effect of the decoration. It is universally admitted by persons of acknowledged taste; and those who have no pretensions to Art are able to see that there is a superior beauty to that which they are accustomed to. It must be because the colour of the natural materials is superior to any kind of painted decoration. Yet all the materials used are not of a costly character. Some of the most simple and inexpensive are introduced. Brick, tile, deal, &c., are used, and no attempt made to conceal them.

Who would wish that the stained deal should be painted in imitation of oak? Or that the other materials of a less costly and inferior order should have been painted over, instead of their natural faces being exposed to view? There are beauties in all the materials used. The inferior serve to set off, by comparison, the more costly, and increase the effect. How much greater is our admiration when we can see that the materials used to produce this effect likewise show us the construction, and convince us that all this splendour is not artificial, but real and lasting! This mode of decoration is one which I think should be well studied; and although the limits generally to the expense of other works will not admit of such costly materials being introduced as in the example just named, still a great deal may be done with simple and inexpensive materials; and, by well-studied and careful arrangement of natural colour and effect, as much truth may be expressed.

I think the same rule may be carried out to a great extent, and that successfully, in the internal designing or finishings of our domestic architecture.

Why should light and dark woods be commonly used, in combination with each other, in our joinery? Wood may be stained of various shades from light to dark. The dirt or dust does not show more on stained wood than it does on paint, and can be as easily cleaned and refreshed by periodical coats of varnish. Those parts subject to constant wear and tear can be protected by more durable material, such as finger plates, &c.

Doors made up of light deal panel with darker material for the rails and styles, or varied in the staining, would, I think, look as well as the ordinary graining. Good and well-seasoned materials would have to be used, and the joiner's work well fitted and constructed. Mouldings of a superior character, and in some cases gilt, might be used for the panels, &c. Dark and durable woods might be used in parts most exposed to wear and tear.

Treads of stairs might be framed with oak nosings, if not at first, at least when necessary to repair the nosings.

Skirtings varied by using dark and hard woods for the lower part or plinth, lighter wood above, and finished with superior mouldings.

Window boards and nosings of oak.

This must be taken as suggestive only. It would, undoubtedly, be more expensive than the common method of painting, when extreme cheapness is required; but I think it would, in many cases, be better than graining, and cheaper in the long run.

Miscellaneous.

Carburetted Gas in London.

At the last meeting of the city Commission of Sewers, Deputy Lott moved that it be referred to the engineer and the medical officer, to examine and report whether the light from the gas-lamps in the public streets was increased or diminished by the carburetting process recently applied to them, and whether the light thrown upon the footways was not, as he submitted it was obscured by the shadow of the boxes containing the material used in the process. In the course of a discussion on this subject, Mr. Haywood engineer to the Commission, read a letter addressed to him by Mr. Massey, secretary to the Great Central Gas Company, complaining that the Carburetting Company, in applying their process to public lamps within the city, were picking out a lamp here and there for the purpose, to the inconvenience of the company. Mr. Massey also stated that a few days ago, as the Carburetting Company's men were fitting one of their naphtha boxes to a lamp in Queenhithe, it exploded. This, he added, was the third accident of the kind that had occurred within the last three weeks. The directors of the Great Central Company had directed him to call the most serious attention of the Court to an instance of explosion in a bracket lamp in Harrow Alley. Had, he said, one of the numerous lamps fixed in the rear of the same premises ignited, instead of the lamp in question, the great probability was that occuring as it did late in the night, the whole block of houses and buildings used as cattle sheds, would have been burnt down. The owner of the property had made a communication as to the risk she was incurring, and expressing great fear and anxiety for the future. Dr. Abraham said probably the accidents referred to which were exceptional, were due to mismanagement, and therefore preventable. At all events, they were not of a nature to induce the commissioners to abandon the carburetting process, by which a great saving of money was being effected in the public lighting, and which, he believed, would be eventually adopted over the entire metropolis. Mr. H. Lowman Taylor held that the saving of money was at the expense of light, for he had observed on a recent occasion, late at night, a sort of twilight gloom in places where the process was in use. Besides, it was obvious that the boxes containing the naphtha attached to the public lamps, threw shadows on the ground. Dr. Abraham said it was well known, long before the carburetting process was adopted, that at advanced hours of the night, there was always a paucity of gas, consequent upon the companies relaxing their pressure. The subject, on the motion of Deputy Harrison, was eventually referred to the General Purposes Committee, for deliberate inquiry and report.—*London Engineer.*

Valuable Substitute for Metal.

Adamas as a substitute for metal in the manufacture of gas-burners has frequently been mentioned, and it has also been stated that the same substance was equally applicable to various other purposes for which metal has been employed. The

use of the "adamas" burners has recently become very general, and Mr. Leoni, the inventor and manufacturer of them, has now succeeded in introducing adamas taps and adamas machine bearings, the working of which has given the greatest satisfaction to those who have employed them. The mode of manufacture consists in reducing the silicate of magnesia to an impalpable powder, and then moulding it into the desired form, and annealing it, the result being that with the greatest facility the utmost precision may be obtained. When employed for taps, the advantage is that an article is produced upon which neither heat nor acids have any effect, at a merely nominal price, and it is anticipated that at no distant period "adamas" steam-cocks will come into general use, to which purpose the material is undoubtedly well adapted, since upon a trial of a couple of ordinary adamas beer-taps (the price of which will be but 1s. or 1s. 3d. to the retail customer) the one began to leak at a pressure of 65 pounds to the inch, and the other stood upwards of 80 pounds, without being affected. But the purpose to which the material may be considered as more especially applicable is for the manufacture of machine bearings, the test which it has stood in this direction being certainly all that could be desired. A steel spindle was run in an adamas bearing for 100 entire days consecutively, at a speed of about 1500 revolutions per minute, yet neither the spindle nor the bearing show the slightest appearance of wear, and several other experimental tests have proved equally satisfactory.

But as a single practical application is preferable to any amount of experimental testing, it may be stated that at the works of Mr. H. Grissell, the well known engineer, a bearing has been for some time in use, and appears to succeed completely. They use it as a fan bearing as a substitute for Babbitt's patent white metal bearing, brass having been previously proved to be quite inapplicable, owing to the great friction and resulting heat, and although the shaft makes nearly 1000 revolutions per minute, it is found that the "adamas" bearing remains quite cool, requires oiling but once a day and shows no appreciable signs of wear. In the position in question the life of a Babbett's bearing is five weeks, and it is confidenty believed that the "adamas" will last for more than as many months.

Aniline in Photography.

Aneline colours, when dissolved in alcohol, and thickened with varnish, have been used with success in tinting albumenized photographs, and are suitable for transparencies on glass.

A New Discovery.

M. Luis Lucas, a gentleman well known for his scientific attainments, on Thursday last received a select circle of visitors at his house, to exhibit and explain the principle of an apparatus of his own invention, by which a physiological fact of great importance is rendered apparent, viz., the direct action of the living frame on the magnetic needle. The apparatus itself is of extraordinary simplicity. A single element of Bunsen's battery has its poles in communication with an electromagnetic bobbin, surmounted by a graduated disc, bearing a magnetic needle which oscillates freely round the centre, as in the common compass. This part of the apparatus is protected by a glass shade ; the plate may be raised and lowered at pleasure by a wheel and rack. The conducting wires, after communicating with the bobbin, branch out towards the operator, and are connected together by a loose metal chain. The apparatus being in this state the needle remains perfectly quiescent, until the operator takes hold of the chain, either with one hand or both, when the needle at once begins to move, describing arcs of from ten to ninety degrees. No principle hitherto admitted into physical science can account for this strange phenomenon, and we are compelled to admit a physiological action capable of producing such motion. The experiment was varied in many ways in our presence, and we were ourselves allowed to test our individual power on the needle. That the cause of the motion was of a physiological nature was further proved by the circumstance that the oscillations of the needle varied in intensity according to the persons experimenting, and even according as the same person might be differently affected either by tranquility or a warm discussion, such different states naturally modifying the susceptibility of the nervous system. Stranger still, some persons present produced the oscillations by merely touching the chain with a glass rod about two metres in length, glass being, as our readers know, a non-conductor. Whatever explanation may hereafter be given of M. Lucas's discovery, one fact seems even now indisputable, namely, that the human body may directly influence the needle ; what consequences may be evolved therefrom time alone can show.—*Galignani.*

Strange Spontaneous Combustion.

The Woodstock (C. W.) *Times* reports a remarkable spontaneous combustion which occurred recently in that place. It appears that at the close of the day's business operations, the practice of the parties in whose premises the case happened, has been to rub the counter with linseed oil, leaving the oil to penetrate the wood during the night, to be cleaned off in the morning. This is done with cotton rags, formed into a ball secured tightly. In the present instance, the rags or balls of cotton cloth after use were left on the end of the counter, unconnected with any substance that would readily take fire, and the only mischief that resulted was the disfigurement of a portion of the counter. But one of the two balls ignited. The inference is that the one that burned was rather more tightly tied. Had the premises been consumed, the origin of the fire would forever have remained a mystery. From this occurrence a lesson may be gathered, namely, that rags saturated with linseed or in fact with coal oil, and allowed to remain in a compact condition, are liable to take fire. The rags in the case under notice, had not been long in use, and, with the exception of the oil, were free from any other substance.—*American Railway Review.*

Most animal and vegetable oils have a strong affinity for oxygen, and when their surfaces are sufficiently extended they will absorb it so rapidly as to take fire. But coal oils have no affinity for oxygen, and will not absorb it, hence they are not

liable to take fire by spontaneous combustion. This property adapts these oils to preserving metal from rust, and to many other uses.—*Scientific American.*

Art and Manufacture.

Flaxman was always proud of his early works in connection with Wedgewood. He felt that, in wedding Art to Manufacture, in producing, for example, his beautiful chessmen, or his exquisitely formed cups, he was aiding in disseminating a taste for Art and a love of the beautiful. It is to be hoped the time will soon come, when every article of domestic use may be obtained of tasteful design; none the dearer because elegant, appropriate, and harmonious. To bring this about, we want, not merely educated Art-workmen, but an Art-educated public. If people will not buy vessels of beautiful form, or carpets of harmonious tints and sensible, truthful patterns, we may be be sure that manufacturers will cease to produce such, and will content themselves with those works of questionable taste which command more favour. *Universal Decorator.*

Phenic Acid.

M. Lemaire has investigated the nature of this substance—one of the numerous products of the distillation of coal-tar. In a paper read before the Academy of Sciences, he stated that anatomical specimens and animals might be preserved in a fresh condition in vessels smeared over on the inner surface with phenic acid, provided that the vessels are hermetically sealed so as to prevent the removal of the air contained in them. The bodies of animals injected with an aqueous solution of phenic acid, may be kept without any alteration in atmospheric air. In this manner, M. Lemaire says, the body of a man may be preserved at an insignificant expense. This acid is also useful as a curative in tinea, scabies, and other diseases. In the latter malady, acetic acid is added to the phenic acid for the purpose of enabling it to penetrate beneath the epidermis to the roots of the hair.—*Am. Gas Light Journal*

Steel for Fire Boxes.

Steel has been for some time successfully used in fire-box plates on the Scottish Central Railway, and Messrs. Cammell and Co.'s steel has been similarly used, for a long time for fire boxes on the Great Western Railway of Canada. On the last named line two boilers for heavy freight engines have been made.

Mineral Oils and their Uses.

A sample of the Canadian oil has been forwarded to Dr. Muspratt for analysis, and he finds each 100 parts to yield upon distillation—of light coloured naphtha, having a specific gravity of 794, 20 parts; heavy yellow naphtha, with a specific gravity of 837, 50 parts; lubricating oil, rich in paraffine, 22 parts; tar, 5 parts; charcoal, 1 part; and loss, 2 parts=100. From this it will be seen that one half of the crude oil consists of an illuminating fluid of great purity and absolutely safe, and by extracting the lighter spirits from the 794 naphtha, as is stated to be so successfully done by the Asphaltum Company, and leaving more of the paraffine in these naphthas, it would not be difficult to bring into the market, from every 100 gallons of the crude oil, 80 gallons of good quality illuminating oil, and in addition to which there would be the profits derivable from the lubricating oil and the mineral turpentine, so that the treatment of the oil cannot fail to be remunerative to those engaged in the business. At present sulphuric acids and alkalies are, no doubt, dear in Canada and Enniskillen the place at which the wells alluded to are situated has not very great accomodation for getting the oil to market, but these are obstacles which in the course of a few months will have entirely disappeared. So far, all that has been thought of is the rendering of the crude oil marketable principally as an illuminating oil, because in this form it would be most readily saleable in the Canadian market, but some disadvantages would result from treatment in this way, and consequently if a market be secured in Europe the profits would be much larger. The product which Dr. Muspratt inaccurately describes as light-coloured naphtha is really a similar product to that sold as benzole, which is the basis of the very beautiful colours described by Dr. Crace Calvert, F. R. S., in a paper recently read by him before the Society of Arts. The so-called heavy yellow naphtha is an inexplosive illuminating oil, which would sell readily at the price of the best paraffine oil; it is, in fact, a superior kind of Belmontine oil, and if its more valuable portions were removed by bleaching it would be be difficult to distinguish it from Belmontine. As the raw material for the manufacture of gas, the Canadian oil is especially valuable; in fact, the crude oil can scarcely be distinguished from the hydrocarbon, used by Mr. John Leslie, of Conduit-street, London, for the instantaneous manufacture of gas of high illuminating power, and proposed by him to be exported to all parts of the world. It could even be used as a substitute for coal itself in stoves which are constructed for burning it; usually, however, preference would be given to the manufacture of gas, and then to use the gas as the heating medium. The petroleum oil is also useful as a wood-preserver, and when forced through the pores, as in Boucherie's process, will last for a very lengthened period without showing signs of decay.

Destruction of Small Birds causing Alarm.

For several seasons, and particularly the last, there was found to be a scarcity of breadstuffs in France. This state of things caused great alarm, and memorials were presented from some of the departments to the Minister of Agriculture, the Legislative Chamber and the Emperor. An elaborate report has been made on the subject, in which the destruction of small birds is charged with being one of the leading causes of deficient crops. The destruction of small birds has gone on increasing, and in a corresponding ratio has also proceeded the increase of those insects and reptiles which prey on the crops of grain and all kinds of vegetable food; and on these insect tribes the small birds live. To that degree of alarm has the public mind been brought that inquiry and investigation have been instituted, and have demonstrated the fact that the destruction of the beautiful feathered songsters may, if continued, lead to something like positive famine. This document has been translated and is being circulated in England, to aid in arresting the wanton destruction of birds in that

country. It was the subject of a paper recently read before the National History Society of Regate, from which we cut the following:—"Although the sparrows levy a small contribution on the farmer's grain, yet the far greater portion of their food is from injurious insects, and the whole of the food they give to their young is from the tribe of insects. At the beginning of the world man would have succumbed in the unequal struggle if God had not given in the bird a powerful auxiliary—a faithful ally—who wonderfully accomplishes the task which man is incapable of performing—in fact against his enemies of the insect world man would be powerless without the bird."—*Moore's Rural New Yorker*.

Oil Region of Pensylvania.

Appended to a report on the Oil Region of Pensylvania, in the *Oil City Register*, of May 15, is the following recapitulation:

"Number of wells now flowing	75
Number of wells that formerly flowed and pumped	62
Number of wells sunk and commenced	358
Total	495
Amount of oil shipped	1,000,000 bbls,
Amount on hand to date	92,450 bbls.
Present amount of daily flow	5,717 bbls.
Average value of oil at $1 per barrel	$1,092,000 00
Average cost of wells $1,000 each	495,000 00
Machinery, buildings &c., from $500 to $7,000 each	500,000 00
Total number of refineries	25."

The Iron-Plated Navy of France.

The *Revue Contemporaine* states that the plan of the first iron-plated frigates was signed March 20th, 1858, long before the matter was approached by England or any other country. There are now four of these frigates afloat, the *Gloire*, the *Invincible*, the *Normandie*, and the *Couronne*, all of which have been tested at sea, with the most satisfactory result. Each of these has an armament of thirty-six rifled guns, of which thirty-four are in the battery, which is plated with iron from end to end. Two guns only are placed on the upper deck and will carry four miles. The crew is composed of 570 men, the engines are 900 horse power, and the length of the ships is 231ft. Besides these there are four iron-plated batteries, intended not for sea but for harbour defences; they are the *Peiho* the *Saigon* the *Paixhans* and the *Palestro;* these are not yet quite complete. Two more iron-plated frigates, on a plan different to the *Gloire* are building, the *Magenta*, and *Solferino*. Besides these there are ten other frigates of 1000 horse power building in the Imperial dockyards, and six new floating batteries have been ordered by private builders, and are being pressed on with all haste. The iron fleet of France thus consists of 16 frigates, afloat or nearly completed, and ten floating batteries.

Cowper Cole's Cupola Principle.

Arrangements are nearly completed at Her Majesty's dockyard at Sheerness, for the construction of a new iron-cased steamer, to be built on Coles's cupola principle, with two shields. The dimensions of the vessel are as follows:—length between perpendiculars. 185ft.; length of keel for tonnage, 148 ft.; extreme breadth, 42ft.; breadth moulded, 41ft. 9in.; depth in hold, 19ft. 10in.; and burden in tons, 1385. She will draw about 16ft. of water forward, and 17ft. aft. Her stem will be constructed somewhat after the pattern of the *Defence* and the *Resistance* iron-cased frigates. What has been chiefly kept in view in the design of the vessel, is to combine great speed with great power of resistance.

Foreign English.

The following choice specimen of English composition is daily distributed in the Western Annex of the International Exhibition. "Balthasar Danzer, manufacturer of Bellows a Munic, recomends his theuv-pre-du-cing apparatus made for the irrigation of tender plants and calculated fr destroying plant lice. Price L4. s. 15. His second apparatus intended for domestic use serves for the pur pose of destroying bugs batles cock reaches and all other noisome chafers in house a Kitchens Pr: 6s. 6d."

Cohesive Strength of Metals, &c.

Cast iron, 42,000 pounds; iron bar (best Swedish and Russian), 81,000 pounds; ordinary 68,000 pounds. Steel bar, soft, 120,000; razor tempered steel, 150,000 pounds. In steel, and *willow* wood, the *cohesive and repulsive* strength appear to be nearly equal. Oak will suspend much more than fir; but fir will support twice as much as oak, probably on account of the curvature of the fibres of oak. Although iron, at an average, is four times as strong as oak, and 5½ times as strong as deal or fir, yet it is more liable to accidental imperfections; and when it fails it gives no warning of its approaching fracture. Wood, when it is crippled, complains, or emits a sound, and after this, although it is much weakened it may still retain strength to be of service.—J.B.

Microscopic Writing.

Amongst the mechanical marvels of the Exhibition is a machine exhibited by Mr. Peters for microscopic writing, which is infinitely more wonderful than Mr. Whitworth's machine for measuring the millionth of an inch, which excited such astonishment in 1851. With this machine of Mr. Peters', it is stated that the words "Matthew Marshall, Bank of England," can be written in the two-and-a-half millionth of an inch in length, and it is actually said that calculations made on this data show that the whole Bible can be written *twenty-two times* in the space of a square inch.

Substitute for Cotton.

The Conserva Plant.—It is met with in every ditch and pool, especially in old clay pits, and in most slow streams. It is of a soft substance, and in pure water, where the threads grow long, resembling tow. But in muddy waters, where they are short, it is not unlike cotton; which being carefully collected and dried, turns whitish, and has sometimes been used for it, either as wadding, or to make towels and napkins, for stuffing beds, and for making paper. In every country there is a great annual waste of cotton used in wicks for candles and lamps, and, in order to economise cotton for the future, I strongly commend this plant, as a substitute, to the parties most interested.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

AUGUST, 1862.

THE USE WE MAKE OF OUR MINERAL RESOURCES.

Although it is well known that the mineral resources of Canada are both varied and extensive yet they do not figure in the annual returns of the productive interests of the province, as growing in the ratio we should expect from the increasing productive power of the country. The value of the produce of the mine for the years 1859, 1860 and 1861 was as follows:—

1859.	1860.	1861.
$468,512	$558,306	$454,963

The year 1861 was for all interests except those of agriculture an unproductive year.

The produce of the Fisheries fell from $832,646 in 1860 to $663,700 in 1861; manufactures fell from a value of $502,037 in 1860 to $289,130 in 1861, but the products of the farm rose on account of the splendid harvest of last year, from $14,259,-225 in 1860 to no less than $18,244,631 in 1861. These numbers refer only to the value of exports, and although they afford an approximate indication of the condition of the several industries of the country, there is good reason to suppose that the consumption in Canada of home manufactures is considerably on the increase, and consequently the utilization of the mineral resources of the country may be rapidly augmenting at home although our exports exhibit a decline. No doubt the present condition of the United States afford some explanation of this state of things. The Descriptive Catalogue of the Economic Minerals of Canada by Sir W. E. Logan, F. R. S., furnishes us with the best data at command for obtaining information respecting the present products of the mine, and we avail ourselves of this admirable guide in the following examination:—

First, then with respect to Iron, as one of the oldest mineral manufactures in the country. The St. Maurice forges were established so far back as 1737, at a time when Lower Canada did not contain more than 60,000 inhabitants, and Upper Canada was a complete wilderness from the Ottawa to the St. Clair.(1)

The St. Maurice forges were in operation until 1858. They were supplied with bog iron ore from the seigniory of St. Maurice, and the smelting company employed between 250 to 300 persons in 1831. The smelting operations were performed with charcoal, but in 1858 the establishment of the Radnor forges in the seigniory of Cap de la Madeline, on a tributary of the Champlain River, where ore and wood are still abundant, threw the St. Maurice forges out of blast. The chief manufacture of the company consists of cast iron car wheels, which cost at the forges 2⅝ cents a lb. A rolling mill has recently been erected at the establishment for the rolling of scythe iron at 3½ cents a lb., and of nail rod iron at 5½ cents a lb. Limestone for a flux for smelting the ore is obtained near the works, and sandstone for furnace hearths at the Gres Rapids, on the St. Maurice. It belongs to the Potsdam formation, largely developed in Lower Canada. The ore occurs close to the surface in a multitude of patches, distributed over the country, and is brought to the furnaces partly by the workmen of the company and partly by farmers on whose land it occurs. It is washed at the smelting works and contains between 40 and 50 per cent. of iron. The quantity used annually is between 4,000 and 5,000 tons, producing about 2,000 tons of pig iron, and the number of workmen employed varies from 200 to 400. Charcoal burners form an important part of the companies' employées.

The furnaces at Marmora, in the rear of Belleville, Upper Canada, were in operation many years ago, and iron of superior quality was manufactured from a succession of single beds of the black magnectic oxide of iron, one of them one hundred feet thick. The ore contains between 60 and 70 per cent. of iron. Different companies have from time to time renewed smelting operations for short periods, but the distance from a shipping port has proved an obstacle to success.

About 4,000 tons of magnetic ore were exported in 1859 from a bed 200 feet thick, situated on Mud Lake, a part of the Rideau Canal. It is supplied at Kingston for 2½ dollars a ton, whence it is taken to the smelting furnaces at Pittsburg, in the State of Pennsylvania. It is found more profitable to take the ore to the coal than the coal to the ore. In 1858 a company of smelters at Pittsburg opened a mine in the township of Hull, on the Ottawa, and up to 1858 they had exported about 8,000 tons to Pittsburg, but since the opening of the rich bed on Mud Lake they now obtain their supply from the latter. A bed of ore was formerly worked in the township of Madoc and smelted close to the deposit; also, one has been recently opened in the township of South Sherbrooke, and conveyed to the Rideau Canal for

(1) The population of Lower Canada was 26,904 in 1714 and 65,000 in 1759, showing an increase in 45 years of 38,096 souls. —Bouchette.

exportation. The troubles in the United States have, however, so far diminished the exportation of iron ores that while their value in 1859 amounted to $25,765, in 1861 they fell to $2,430. The same influences diminished the exportation of pig and scrap iron to the United States, most, in all probability, originally of foreign origin, from $75,373 in 1859, to $5,759 in 1861.

Copper.

The Bruce Mines, on Lake Huron, opened in 1847, have yielded about 9,000 tons of eighteen per cent. The quantity obtained in 1861 was 472 tons, containing 17 per cent. of copper. Smelting furnaces were erected at this mine in 1853, the fuel used being the bituminous coal from Cleveland, on Lake Erie. After a trial of three years the Montreal Mining Company ceased smelting, and leased their works. The Wellington Mine belonging to the West Canada Mining Co., is going on much more favourably. In a report of a meeting of the shareholders, held in London, in May last, a profit for the year 1861 of £7,501 sterling was announced. If the American markets at New York and Baltimore should show no depreciation, this mine will become very valuable, and the copper of the North Shore of Lake Huron may yet grow to be of great importance to the country. The number of workmen at the Wellington and Copper Bay Mines is supposed to be about 260. The already celebrated Acton Mines, in Lower Canada, had exported to the end of 1861 about 6,000 tons, holding on an average 17 per cent. of copper. In a recent number of the English *Mining Journal* the following paragraphs have appeared :—

"The Acton Mines, Canada.—With reference to these mines, concerning which much interest is felt in this country, Messrs. Willson and Robb write that the ore, in consequence, apparently, of complicated dislocations of the strata, occurs at the surface in a series of bunches of exceeding richness, which have now, for the most part, been extracted by open quarrying ; but on tracing this ore in depth, these bunches appear to be connected with regular viens, which afford promise of being permanently productive, although by a different and more satisfactory mode of working. In the absence of full official returns, it may be safely estimated that the Acton Mine has, up to this date produced not less than 6,000 tons of ore, averaging 17 per cent. produce, worth about $400,000, at a cost of about one-fourth that sum. Although as yet, with the exception of Acton and Harvey Hill Mines, no very great progress has been made in the production of ore for the market, the results so far have amply justified the anticipations. Deposits of the sulphurets of copper, more or less promising, have been found to exist on upwards of 150 distinct lots in the various townships. On nine or ten locations, at great distances apart, shafts have been sunk to a considerable depth, and in as many instances large sums have been expended in costeaning and trenching ; and in almost all cases the deposits, when traced in depth, have been found rapidly to improve in all the qualities requisite for permanent and profitable mining; and we have at the present time, many setts which appear only to await the application of a moderate capital to become permanently productive."

In 1859, the total value of the copper ores exported from Canada amounted to $340,686 ; in 1861 it reached $440,130, shewing a favorable increase in this ore, and one which promises to become rapidly augmented.

Lead.

Of Lead the yield has yet been small in Canada. At Indian Cove, Gaspè, about six tons of ore, of sixty per cent. value, have been obtained. At the Ramsay Mines, in 1858, twenty-six tons of ore, which yielded eighty per cent., were raised. A fifty horse power steam engine has been erected at the mine, and the works are progressing. In Lansdowne, a vein of Galena was opened in 1854, but the results were not satisfactory ; other veins in the same locality have been struck, and works are prosecuted. At Bedford shallow trial shafts have been made, but the results are not publicly known. Of lead in sheets we imported $12,262 in 1861, so that the home production is probably very insignificant as yet.

Gold.

The auriferous area of Eastern Canada is estimated to be about 15,000 square miles. Authentic details respecting the profits of the different gold mining companies which have been formed since 1851, are very difficult to obtain. The workings of the Canada Gold Mining Company in 1851 and 1852, yielded 4987 dwts 30 gr. of gold : the value being $4323.15 ; but the wages of the company amounted to $3532, so that the profit was only $690.

Peat.

Our importation of Coal and Coke for fuel is very considerable ; and, in the neighbourhood of large towns, wood is becoming expensive. We paid for Coal and Coke in 1861, not less than $732,212, or nearly equal to double the entire value of the exports of our minerals. It is gratifying to know that a very considerable area of peat exists in Canada, which may one day become very valuable. The peat at Chambly was at one time cut pressed, and sold, as fuel ; but in consequence of the cheapness of wood and coal, it was not remunerative. There are about 100 square miles of peat on the Island of Anticosti. Large peat bogs occur between the Ottawa and the River St. Lawrenee, and also on the south side of the last named river.

Miscellaneous.

Plumbago.—The workable beds of this mineral occur chiefly on the north side of the Ottawa. Little has yet been done with them.

FRIABLE SANDSTONE.—A bed of crumbling sandstone 20 feet thick occurs in the Township of Pittsburg. It is in much demand for iron foundries, and is shipped to the foundries at Montreal for $3, and to those at Toronto for $2 50 a ton. About 1500 tons are consumed in the foundries of these cities.

FIRE CLAY.—In Dundas and Hamilton the foundries use fire clay from the Clinton formation, which is exposed along the great Niagara limestone escarpment, west and north of Lake Ontario.

BUILDING STONES.—See June number of this Journal.

SLATE, FLAGSTONE, LIME, BRICK AND DRAIN TILES, GRINDING AND POLISHING MATERIALS, &c., &c.—See June and July number of this Journal.

PETROLEUM.—See July and other numbers of this Journal.

Although the mineral wealth of the country is vast, as yet is comparatively undeveloped.

The proportion borne by the exported produce of the Mine to the total value of our exports in the three past years was approximately as follows:—

1859 as 1 is to 50 nearly.
1860 " 1 " 55 "
1861 " 1 " 60 "

The absence of coal is an immense drawback, and with the exception of the Iron mine of Radnor, no attempt appears to be made to use wood charcoal, probably on account of the expense. A very considerable increase in the price of Iron will have to take place, or some new process for smelting it discovered before we can expect the manufacture of this all-important material to assume important proportions in Canada. In contrast to this not very encouraging statement, the estimates for the Lake Superior Iron Trade for 1862 amount to 150,000 tons, which will be shipped from Lake Superior ports.

THE AGRICULTURAL CENSUS OF 1861.

The Census of the Origin and Religion of the people of Canada, and of the Agricultural Statistics of Upper Canada, is at length published without comparison, note or comment. The late Mr. Hutton prefaced the Census Report of 1851-2 with some very valuable and interesting comparisons between the progress of Canada and the United States. Perhaps a similar series may be supplied by the Board of Registration and Statistics when the Agricultural Census of Lower Canada is published. Meanwhile, we cull from the Census Report of 1851 and that of 1861 the following interesting tables which will show in a very striking manner the progress which has been made in Agricultural Industry during the last ten years in Upper Canada. It is much to be regretted, that so far as the data before us serves as the basis of an opinion, manufacturing industry as represented by fulled cloth, flannel and linen has not progressed in a proportion in the least degree commensurate with the general progress of the country.

Comparative Table of the Agricultural Products, &c., of Upper Canada in the years 1851 *and* 1861.

		1851.	1861.
Population of Upper Canada		952,004	1,396,091
Occupiers of land		99,906	131,983
Wheat	bushels	12,682,550	24,620,425
Barley	"	625,452	2,821,962
Rye	"	318,429	973,181
Peas	"	3,127,681	9,601,396
Oats	"	11,391,867	21,220,874
Buckwheat	"	579,935	1,248,637
Indian Corn	"	1,688,805	2,256,290
Potatoes	"	4,982,186	15,325,920
Turnips	"	3,110,318	18,206,959
Carrots	"	174,686	1,905,598
Mangel Wurzel	"	54,206	546,971
Hay	tons	693,727	861,844
Flax or Hemp	lbs.	59,680	1,225,934
Tobacco	"	777,426	....
Maple Sugar	"	3,669,874	6,970,605
Cider	gallons	742,840	1,567,831

It will be observed upon inspection of the foregoing table that in every item enumerated an increase has taken place, in some instances of a very favourable character, indicating progress in the true principles of farming practice.

The cultivation of root crops is progressing with extraordinary rapidity as shown by the production of eighteen million bushels of turnips in 1861 against a little over three million bushels in 1851. The production of mangel wurzel has increased ten-fold; wheat has doubled itself; barley shows more than a four-fold increase; peas three-fold, and the production of flax and hemp in 1861 is twenty times greater than in 1851. The cash value of the farms of Upper Canada reaches the enormous sum of two hundred and ninety-five million dollars. We now turn to the live stock as shown in the following:—

Comparative Table of Live Stock in Upper Canada in the years 1851 *and* 1861.

	1851.	1861.
Bulls, Oxen and Steers	192,140	99,605
Milch Cows	297,070	451,640
Calves and Heifers	255,249	464,083
Horses(1)	201,670	377,681
Sheep	1,050,168	1,170,225
Pigs	571,496	776,001
Total value of live stock..	———	$53,227,486

(1) Including Colts and Fillies.

The remarkable diminution in the numbers of bulls and oxen arises, probably, from the more general use of horses for farm work. The small increase in the number of sheep is surprising, but from the wool returns the fleece must be much heavier than formerly, for while the increase of the number of sheep is only 120,057, the excess of the wool crop of 1861 over that of 1851 exceeds one million pounds.

The third comparative table to which we now turn relates rather to manufactures than to agriculture, it exhibits the mode in which the raw material was utilized, and the progress made in domestic manufactures.

Comparative Table showing the number of Yards of Fulled Cloth, Flannel and Linen Manufactured in Upper Canada in 1851 *and* 1861 *respectively.*

		1851.	1861.
Fulled Cloth	yards	531,560	497,520
Linen[1]	"	14,711	37,055
Flannel	"	1,157,221	1,595,514

In the manufacture of fulled cloth a marked diminution is perceptible, but a considerable increase has taken place in the production of linen and flannel, yet far from being so large as might reasonably have been anticipated from the remarkable progress of the country in agricultural industry.

THE PROVINCIAL EXHIBITION.

In less than two months the largest and most complete exhibition of Canadian Industry will be held in Toronto. Preparations on a very extensive scale are fast drawing towards completion. It remains for the manufacturers and artizans of Canada to show that progress in every department has been made, commensurate with the rapid increase of wealth and population which has taken place since our annual exhibition was last held at Toronto. We say to all, in whatever branch of industry you may be engaged, send some illustration of your work to the next Provincial Exhibition, even though it may not be attended with any immediate personal gain, yet it will be of advantage to the country at large; it will assist in convincing the stranger that we embrace within our own limits, all the elements of an independent people, and that we are not tied by leading strings to the foreign manufacturer either in Europe or America. It is, moreover, the duty, and it should be the honest endeavour of every manufacturer to send the best productions of his skill to be seen by his countrymen, in order that their confidence and trust in the land which secures them safety, freedom and maintenance may be increased and strengthened. Canada has done well at the Great International Exhibition. She has sustained the reputation she won in 1851 and 1855, and the fruits of her energy in making the display she did are already beginning to be felt. There is one feeling of regret, however; we all know that little aid was given Canadian Exhibitors by the late government to display the rich resources of the country to the best advantage. We all know that although much has been done, much, very much more might have been accomplished if encouragement suitable to the occasion had been offered at an earlier date. With respect to our own forthcoming exhibition, exhibitors are altogether independent of external aid, they must rely upon themselves, and if a patriotic spirit is aroused men will come forward with their works of art, skill and industry and produce such a collection as will surpass the hopes of the most sanguine, and astonish those who do not live in our midst with the abundance of the resources of the country, and with the manner in which they are utilized and displayed. It is anticipated that the influx of visitors from all quarters, both in Canada and the States, will be unprecedentedly large, and we cordially hope that the opportunity for making an ample and complete display of what we can do, and of the condition of our civilization, will not be allowed to pass unheeded by any one who has the welfare of his country at heart, and posesses the power to increase it.

THE ECONOMIC MINERALS OF CANADA.

(*Continued from page* 203.)

MINERALS APPLICABLE TO THE FINE ARTS.

Lithographic Stone.

MARMORA.—At Marmora the Laurentian rocks are overlaid by about twenty feet of brownish-grey and light brownish-buff unfossiliferous compact limestones, with a conchoidal fracture, several beds of which would be well suited for the purposes of lithography, were it not for small imbedded lenticular crystals of calcareous spar, which, when abundant, unfit the stone for such an application. One of the beds, however, which is two feet thick, and of impalpable grain, is a lithographic stone of excellent quality. The lower half is much better than the upper, which is somewhat affected by the lenticular crystals of calcspar. The upper inch, which is just above the thus marked part, fits upon it in tooth-like projections, having columnar sides at right angles to the bed, of an inch long in some places; and usually covered with a thin film of bituminous shale. The same tooth-like forms occur in the lower part, but they are there more obscure. The band to which the bed belongs, presents occasional exposures of a different character, all the way from Hungerford to Rama, a distance of 100 miles; but though the stone has been highly commended by all the lithographers who have tried it, no one has attempted to quarry it for use. The

stone exhibited, presents the *fac simile* autographs of all the governors of Canada, both French and English, from the time of Champlain in 1612 to that of Lord Monck in 1862; with the exception of two of the French governors in the seventeenth century.—*Birdseye and Black River Formation, Lower Silurian.*

Brant.—These are specimens of magnesian limestone of a yellowish drab color and fine texture, with conchoidal fracture. The locality is a bed of a small stream, on lot 31, between ranges 1 and 2, south of the Durham road, Brant, and about half a mile south of the village of Walkerton. About fifteen beds of stone, apparently of the same character as the specimens, occur in a vertical section of nine feet, the thickest being eleven inches. Layers of dark coloured shale separate some of the beds. The band is underlaid by about sixty-five feet of soft clayey strata, constituting the bank of the Saugeen River, at the top of which it occurs. The existence of this stone being a very recent discovery, only a preliminary trial of it has been made. The beds from which the specimens were taken, are intersected by a number of parallel joints, which render the specimens procured somewhat narrow; but the geological place of the band having been ascertained, it is probable that wider slabs may be found on the strike, in some other locality.—*Onondaga formation, Upper Silurian.*

Oxbow, Saugeen River, Brant.—This stone is of the same character and from the same formation as the last. The locality is at the edge of the river, on the east side of the lot indicated in Brant. Two beds, of four and five inches respectively, occur here, but they were covered with water at the time the place was visited.—*Onondaga formation, Upper Silurian.*

MISCELLANEOUS MINERALS.

Peat.

Chambly.—Peat occurs near Chambly, on the south side of the St. Lawrence, and was some years ago cut, pressed, and sold as fuel by the late Mr. Scobell. The consumption, however, was scarcely sufficient to encourage the industry. As Canada is deficient in coal, when wood becomes scarce in the progress of settlement, peat will gradually assume some importance as a fuel in many parts of the country. Peat occurs in great abundance in many places in the province; about 100 square miles of it extend along the south front of the Island of Anticosti. Successive areas of it are met with on the south side of the St. Lawrence, from Rivière du Loup to Ste. Marie de Monoir, opposite Montreal; on the north side it occurs at La Valtrie and other places. Large peat bogs occur between the Ottawa and St. Lawrence, and there are many of the same character to the westward. The peat which is sufficiently matted to hold together when dried, usually supports a growth of prairie grass, or ericaceous plants, or of tamarac trees. That which occurs in cedar swamps is deficient in the fibrous plants which give it cohesion, and it falls to powder when dried.

A new bronze is being much used by workers in metals. It is made by melting together 10 parts of Aluminum with 90 of Copper. It is said to be as tenacious as Steel, and well adapted for the bearings of machinery.

THE INTERNATIONAL EXHIBITION.

WESTERN AND EASTERN ANNEXES.

(*Extracts continued from "The Mechanics' Magazine."*)

Steam Traction and Portable Engines.

The first of these which arrests our notice is one exhibited by Bray's Traction Engine Company. This, considering its great capabilities, is a remarkably compact and simple looking piece of locomotive machinery. It was built at the factory of the company, by order of the Government, and when it has played out its quiet part at the great show, is intended for active service in Woolwich Dockyard. It combines many improvements upon the earlier contrivances for the purpose of transporting heavy weights by steam power; but the feathering principle of the wheels, as originally introduced by Mr. Bray, is retained. This principle consists in the circumference of the wheel having a number of small apertures through it. These apertures are the media which allow of the protrusion and withdrawal, by means of an eccentric, of a series of blades, or teeth. The teeth may be adjusted to the nature of the soil, or paving, over which the engine has for the time to travel; that is, they may be lengthened or shortened, so to speak, at the will of the attendant. In many cases the teeth are not required to be protruded at all, the friction of the periphery of the wheel being sufficient for the purposes of traction. In such case the blades may be thrown out at the top, or on that part of the wheel not coming in contact with the road. On the contrary, in the event of the ground being soft or slippery, or of the engine having to ascend a steep incline, the powerful auxiliary aid of the teeth can be brought into action, and the requisite amount of biting ensured.

It has been objected that the teeth may damage the roads over which the engine travels, but as the wheels take a broad bearing thereon, it is difficult to see the force of the objection. Power is transmitted by means of pinions hung on the crank shaft, and which work into rack wheels attached to the arms of each driving wheel near its outer circumference. Arrangements exist for altering the speed and the power, so as to suit the circumstances of the occasion upon which it is used. The engine exhibited is not intended solely for traction purposes, however, for it is fitted with a drum, which renders it available for driving any kind of fixed or portable machinery. It may thus be made available for an infinite variety of duties, in addition to its primary and nominal ones. It is, in fact, an engine of all work, and, in this capacity, is destined, we imagine, to be particularly serviceable at Woolwich Dockyard. Some other special features about this valuable steam appliance deserve notice, and they are, the introduction of an improved mode of steering, and of outside bearings, for the driving wheels, which also are mounted on springs on both inner and outer framings. It may be stated, moreover, that one of the powerful engines of this company was employed in the conveyance of ordinary locomotive engines, heavy castings, and machinery of various kinds from the docks, railway stations, and manufactories, to their destinations at South Kensington. It was thus a potent contributor to the magnificent display of machinery in the Western Annexe. The load conveyed at one time,

by this engine, occasionally amounted to 45 tons.

Messrs. Chaplin and Alexander, of Glasgow, also exhibit a traction engine, of a lighter character than that just referred to, but well adapted nevertheless, for many purposes. In addition to this, the same firm supply the contractor's locomotive, which is intended to work on rails or tramways, of a gauge from two feet upwards. This is simple in construction, and the working parts are easily accessible for repair. Portable cranes, hoisting engines, and light portable engines for agricultural and other purposes, go to make up the display of Messrs. Chaplin and Co.

Taplin and Co., of the Traction Engine Works, Lincoln, are exhibitors of a traction engine of a different form to those of other competitors in the same path. This has a singularly light appearance; but it has double cylinders, is of 16-horse power, and has many advantages peculiar to itself. One of these last consists of an apparatus for regulating the height of water when going up or down hill. The mode of steering is simple and effective, and arrangements are made for carrying a sufficient supply of fuel and water for a journey of twelve miles. Fifty tons is the weight it is computed to draw. It is, therefore, well suited to the uses of contractors and others engaged in the erection of buildings, bridges, or other works of magnitude. Messrs. Taplin and Co. also show a 12-H.P. engine on the same principle, and intended for steam ploughing, thrashing, and other operations of the farmer. An 8-H.P. portable steam engine, manufactured by Messrs. Brown, Williams and Charles M. May, of North Wilts Foundry, Devizes, is a very excellent specimen of this kind of machine. From the fact that the cylinder is enclosed when the engine is working in a jacket or belt of steam, the maximum advantage from employing steam expansively is gained. The lower part of the cylinder casting forms a steam chamber, from which the steam is taken off directly into the valve case without exposure to the effects of cold air. This is an important arrangement, because condensation and priming are thereby guarded against to a very considerable extent, if not entirely obviated. The cylinder, and, indeed, all the working parts, are attached to the top of the boiler, and thus, besides being readily accessible for repairs, are constantly under the eye of the driver.

The engine is furnished with an inside crank, which works between the bearings, so that the fly-wheel can be put on either side of the boiler, and a pulley of smaller size may be hung opposite to it if required. One end of the shaft is also prolonged, so that a coupling may be attached for effecting communication with any machinery at a distance, and employed for steam cultivation or other purposes. A steam pressure gauge, on a patented principle, is connected with the boiler, as well as a glass water gauge, and gauge cocks. The bearings are all of gun metal, and the working pins, nuts, and screws, are all case hardened. The boiler is well adapted for the rapid generation of steam, the heating surface being equal to 20 square feet for each horse power. The barrel of the boiler, which is made of Low Moor iron, and in some cases of steel, is clothed with a casing of hair felt and wood, for the prevention of evaporation, and over all is a protecting covering of sheet iron. The ash pan is fixed close round the fire box, and fitted with a door, which may be used as a damper. The greatest care appears to have been taken to prevent live coals or cinders from falling to the ground, so that the chances of accident from that cause are materially lessened. On the whole, there is no doubt that, for compactness of form, and probable economy of working, the engine of Messrs. Brown, Williams and May will bear comparison with any contrivances used in this country for similar objects. Mr. Holman, of Cannon-street, City, is, we believe the agent in town for this firm.

In the branch of agricultural engineering, which is becoming every day of more and more importance, and which is attracting more and more the attention of the general engineers and machinists of the kingdom—in this branch Mr. Burrell, of St. Nicholas Works, Thetford, Norfolk, shines conspicuously at the International Exhibition. Perhaps the combined portable engine and windlass is the most noteworthy of the specimens of agricultural machinery from the Thetford Works, and of this and its mode of action, therefore, we may give a brief description. The cylinder and gearing are placed on the top of the boiler, as it were, but yet independent of it. Any portion of the working parts may thus be removed for repair even while the steam is up. Beyond this there is nothing extraordinary in the construction of the motive portion of the engine, but the mode of communicating motion to the windlass and the windlass itself are worthy of remark. The windlass consists of a single sheave five feet in diameter, and around which the rope is made to take half a turn. The groove into which the rope passes is formed of a series of small leaves, which, on the application of the least pressure, clasp and hold the rope until it takes the straight line on the other side, when the clips open and release it. By this simple and self-acting arrangement, all short bends which are found to be so detrimental to wire ropes are avoided. The small "leaves" referred to are made of chilled cast-iron, which, of course, is not liable to wear rapidly, and they may readily be removed and replaced when desirable. An upright shaft, driven by a bevel pinion on the crank-shaft, puts the windlass in motion.

The plan of working is thus described by the maker of the implement:—"On the headland is placed the engine and windlass, and directly opposite to them the anchor, which is set moving. Between these the plough—if a plough be in use—is pulled backwards and forwards, one end of the plough being alternately in the air, and the other in its work, thus avoiding the necessity of turning on the headlands.

The plough being constructed with patent slack gear, the rope is lengthened or shortened as the irregularity of the field may require, and at the same time both ropes are kept sufficiently tight to prevent their trailing upon the ground. By these means a great saving of draught is effected, and the wear and tear of the rope by friction is obviated." Any other implement than the plough may, of course, be worked in the same manner.

The anchor used with the combined engine and windlass, is a patented contrivance, and is so made

that its resistance to side strain is due to disc wheels which cut their way for some distance into the ground. The frame is entirely composed of wrought iron, and a box at the back is intended as a counterpoise to prevent the apparatus being pulled over when engaged on very heavy work. This machine is managed by a boy, who also attends to the shifting of the rope porters. Patent balance ploughs, and cultivating machines, flour mills, and thrashing machines, are exhibited in the Eastern Annex, by Mr. Burrell, together with many other appliances of minor importance.

The well-known firm of Clayton and Shuttleworth, in addition to their various contrivances for facilitating the operations of agriculturists and others, exhibit two specimens of portable engines. These consist of the "improved outside cylinder engine," and the "portable steam engine;" they are both creditable productions, and may be made applicable to numerous purposes, besides those of agriculture.

Messrs. E. R. and F. Turner, of Ipswich, who have been exceedingly successful at the various shows of the Royal Agricultural Societies of this and other countries, exhibit amongst a great number of steam and hand implements for the carrying on of agricultural operations. Amongst these is a small portable steam engine, which has some excellent points about it. The cylinder is 6¼ inches in diameter, and the length of stroke 10½ inches. The fly-wheel, which also serves as a driving pulley, is 4 feet 4 inches in diameter, and it is intended to make 140 revolutions per minute. The crank-shaft is of wrought-iron, and admits of the fly-wheel being hung at either end, as may be found most convenient, and of the attachment of an additional pulley when necessary. The strength, simplicity, and cheapness of this appliance, constitute its strongest recommendations, and it is not improbable, we think, that at the present show of the Royal Agricultural Society of England, at Battersea Park, the Messrs. Turner may add another laurel to their chaplets—or at least another medal to the number already won by them.

In the way of traction engines, the Messrs. Robey and Co., of Lincoln, to whom reference was made in a former notice in respect to other contrivances, give us a very good example of their capabilities in this particular department; and Messrs. Richard Hornsby and Sons, of the Spittlegate Iron Works, Grantham, are not behind their neighbours in their display of portable steam engines and agricultural implements generally. The double-cylinder engine of this firm, is, indeed, a well contrived and determined looking machine.

THE AMERICAN COURT.

(*Continued from page* 200.)

Among the many useful inventions from the United States, perhaps the most remarkable is the power loom for weaving tufted fabrics, to be seen in operation in the Western Annexe. This loom is the invention of Mr. Smith, West Farms, New York, and is intended for weaving the Axminster carpets, or any other tufted or pile fabric which requires cutting, and is produced to a pattern. Unlike either the Jaccquard or the old draw loom, the pattern designed is formed by the arrangement of the spools or bobins, which are suspended over the machine to the number of 270. These produce a pattern the whole width of the material and 1½ yards long; and at every throw of the shuttle a piece of mechanism rises up like so many fingers, catches hold of the worsted threads, and weaves them in, across the whole width of the fabric. A knife or shears then passes swiftly over it and cuts off the tufts to any length required. By this means any design can be woven in parts, which, when united, will have the appearance of having been woven in one piece, and the loom will produce twenty-five yards per day. As the mechanism for forming and cutting the tufts is readily adjusted to any desired depth of pile, the loom is equally adapted for the manufacture of rugs and mats, and at a cost much less than such fabrics can be produced by any other method. The Americans are very confident of this loom; it has received great attention from scientific men, and Earl Granville has publicly stated that it is destined to achieve greater results than perhaps any other machine in the building.

A curiosity has made its appearance in the American Court within the last week, in the shape of a machine for milking cows. The idea is not a new one, as we have read of machines for the purpose twenty years ago, but the machine appears to be simple and ingenious in its construction, and requires no adjusting in changing from one cow to another. The teats, either two or four at once, are inserted in as many india-rubber tubes; a vacuum is created by working two small levers, and the milk is drawn at the rate of one gallon per minute, in a way more agreeable to the animal than by milking with the hand, and the milking process is more cleanly.

Mr. L. A. Bigelow, Boston, Massachusetts, exhibits several machines connected with boot-making, which receive, as they deserve, much attention. First of all there is a machine for splitting the leather, or rather, as we would describe it, for paring the leather intended for soles to a uniform or required thickness. This is effected by passing the leather between two rollers, one grooved, and the other smooth, behind which is a knife which may be adjusted in relation to the frame according to the thickness of the leather required. The cutting is accomplished rapidly, and with more precision than can be done by the hand and knife. Then we have a machine for cutting up the leather into soles, which it does at the rate of twenty pair a minute, all fitted exactly to the last, without the use of a hand-knife, and the edges sufficiently smooth to finish. Further, there is a "heel trimmer," that is, a machine which, carrying the boot or shoe on a pivot, subjects it under a circular motion to the action of a cutter, which in a minute pares the rough edges to the form of heel, whatever the thickness may be. And lastly comes the sole sewing machine, illustrated by an engraving, which is much on the same principle as the sewing machines for lighter material, with which the public are now familiar. Of course it is more ponderous and powerful, having a force sufficient to penetrate the thickest leather, or even a board half an inch thick. It uses a heavy waxed thread, drawing the thread more tightly than can be done by hand, and making the work both strong and solid. This machine will sew on the soles of one hundred and

fifty pairs of boots or shoes per day, of whatever thickness, and the labour of managing it is a pleasant pastime.

Mr. Bigelow also exhibits Blake's stone breaker, an extremely simple and useful machine for superseding or economising human labour. It is intended for breaking stones for concrete, railway ballast, or metal for roads, and it easily crushes flints, granite, greenstone, and the most obdurate trap boulders to any dimensions required.

It contains two jaws, one, next the end of the machine fixed the other moveable, working upon a pinion at the raised part of the machine just before the fly wheels. Both jaws are armed with teeth, in the form of vertical grooves. The moveable jaw inclines at an angle more or less acute, according to the dimensions it is required the stones should be crushed or broken. This angle is regulated by a simple contrivance behind the moveable jaw, which is put in motion by the action of the fly-wheel working on a crank. The stones to be broken are put into the fore-part, as into a hopper ; the moveable jaw advances and recedes from the fixed jaws ; the stones descend and are masticated, or "chawed up," and issue from the lower part of the machine in fragments of the size required. The great simplicity and power of the stone-crusher is exemplified in a small working model, where flints, about the size of a pigeon's egg, are crushed into atoms in less than a minute, by a few turns of a crank with one hand. The machine is worked by hand-power or steam-power according to its dimensions. As to capacity, a three-horse machine will crush a stone 10 inches by 5 at the rate of four cubic yards per hour.

Goar's belt shifter is a very happy contrivance for shifting and securing machinery belts. Its utility will at once be admitted by those who understand how frequent has been the occurrence of accidents by the common method of shifting belts.

Another very simple contrivance of great use is a machine for addressing newspapers, exhibited by Mr. Sweet, of New York. This apparatus is in use in most of the newspaper offices in New York, and must greatly facilitate the despatch of journals which are supplied directly from the office and not through the intervention of newsvendors. Of course such a machine would be very useful to English newsvendors.

Two presses, exhibited by Eckel, of New York, are remarkable for power, and of very beautiful construction. One is a cotton or baling press, which will put 600 lbs. of cotton into 18 cubic feet, or 500 lbs. of hay in a common sized bale of 5 feet long, 2 feet wide, and 32 inches high.

The other is an oil or tallow press; the curb is of peculiar construction, being an iron cylinder, cast solid, 38 inches in diameter, heavily banded with tire iron on the outside, and the inside is ribbed every inch. There is an iron lining rivetted to the ribs, perforated with upwards of 11,000 holes, which forms avenues or escapes for the oil on the sides of the curb. This curb is placed on a wrought-iron disc or saucer, 4 feet 6 inches in diameter. There are three or more plates for dividing the material, and a centre tube as follows: —The bottom plate is ribbed, and perforated between each rib, to afford great freedom for the oil to escape from the bottom. It has a seat for the *centre tube*, which takes the oil from the centre of the cheese. The centre tube is a stout iron cylinder, perforated with holes from top to bottom, and passing through the centre of the central and top plates, and thus the oil escapes from all parts almost instantly. It will be observed that this press is very simple, having no blocks, or screws or levers about it; all that is required being to put in the plates and turn the cranks which run down the plunger.

There are many other articles in the American Court well worthy of description. We have selected those chiefly which are remarkable for mechanical contrivance or invention, or from their novelty were worthy of a passing record. The sewing machines will be noticed in a future paper. As we stated at the outset, the United States have, under a distressing peculiarity, done wondrously well; and ere another decade shall have come round, they may be able to show to a greater extent, if not to greater advantage, as regards invention and utility.

CANADIAN TIMBER AT THE INTERNATIONAL EXHIBITION.

"The visitor to the International Exhibition who shall seek for timber will see on his right in the distance, as soon as he enters the Eastern Dome a noble pile reaching nearly to the roof of the transept. When he approaches the pile he will find that its base is surrounded by most admirable examples of what Canada can produce; for he is within our great North-East American Colony, the pride of England, the envy of the United States. There is not such another display from the New World; and when we consider how near is Canada to our own shores, the rapidity of intercommunication between us, and the enormous wealth which this "trophy" represents it is difficult to avoid feelings of something like triumph at such a demonstration of British power. And yet there are those who would pull the trophy down, because, forsooth, it is thought to stand in the way of a painted window. We have not, however, sunk to such effeminacy as to prefer tinsel to iron, or to sacrifice the interests of millions to degenerate taste. For ourselves we own that we admire the work of the Almighty, even in the rude form of timber, very much more than any combination of blue, red, and yellow glass in the Cathedral window. And so does the intelligent part of the public.

To planters in this country the exhibition of timber in Canada, is particularly interesting, because not a tree is represented with which we are unfamiliar. We can grow them all on our own estates if we think it worth the while; and, given time enough, we can grow them as well. More especially does it concern those who already possess old specimens of Canadian trees to study here the evidence what they may come to. Take, for example, Black Walnut, which grows magnificently even near London. There is one specimen (No. 53) which is four feet seven inches in diameter, exclusive of its bark. Such timber can be had at Quebec for £71 per 1,000 feet cube. The specimen to which we now refer must be about 400 years old.

North American Elms thrive perfectly with us. They are, however, we believe, exclusively *Ulmus*

Americana and fulva that have been introduced. We now see that another kind, called the Rock Elm or *Ulmus racemosa*, is superior to them and to our own; the wood being finer in the grain and less brittle. Of this there is a specimen, about 2 feet 8 inches in diameter.

Weymouth Pines are among the commonest of our conifers. They yield the "Pine-wood" of carpenters. Little, however, do our foresters know of the huge specimens that swarm in Canada. "Average height 140 to 160 feet; average diameter 3 to 4 feet; but common near Lake Erie 5 to 6 feet in diameter and 200 feet high; or even in some cases 22 feet in circumference, 220 feet high, bare of branches for 120 feet to the first limb." Such monsters are, however, too big to exhibit, and Canada modestly limits herself to about 2 feet 10 inches. or 3 feet in diameter.

Then there is *Pinus resinosa*, or the Red Pine which dislikes our eastern climate, 3 feet 6 in. in diameter which is about twice its usual size. But there is no encouragement to plant it here.

The Ash of Canada (*Fraxinus Americana*) famous for its toughness and strength, invaluable for the the handles of axes and other implements, is displayed in its small forms as well as in the giant proportions that it assumes when full grown. One round, with 305 circles of annual growth, is 5 feet 10 in. in diameter, an admirable example of timber.

There is oak, too, (*Quercus tinctoria*) red (*Q. rubra*) and white (*Q. alba*) the latter little inferior to British heart of Oak, and not far off 4 feet in diameter. This tree, as much at home with us as with Canadians, is said to be sometimes 21 feet round in Western Canada.

Then we have the Occidental Plane, or Button Wood, 4 feet through; Tulip tree or White Wood, 3½ feet, and Bass Wood or American Lime, more than 2 feet, all excellent for cabinet and joiners' work though unfit to bear exposure to weather.

Add to these numerous specimens of the fair growth of American Chestnut, Hickories, Maples, Beech, Birch, Hornbeam, Hemlock, Spruce, Tamarac, or American Larch, and he who would thoroughly understand the nature of Canadian timber has a field for serious study hitherto unexampled: how serious in a mercantile point of view, may be gathered from the fact, that Canada exports annually about 30,000,000 cubic feet of timber in the rough state, and about 400,000,000 feet, board measure, of sawn timber. The revenue derived by the Province, during 1860, for timber cut in the forests, amounted to about $500,000. It appears that of the 60 or 70 varieties of woods in its forests there are usually only five or six kinds which go to make up these exports so vast in quantity; the remaining fifty or sixty timber trees are left to perish or are burned as a nuisance, to get them out of the way. The Commissioners truly observe that by showing in the markets of the world, that it has these valuable woods, and can furnish them at unprecedently low prices, will secure additional purchasers, a result that the capital display in the Exhibition building is admirably adapted to secure. The Commissioners from the Colony state that in extent, and the value and variety of its woods, the great forests of deciduous trees of North America surpass all others; the most remarkable of this great mixed forest being that grown in the valley of the St. Lawrence. The Western coasts, in high latitudes, furnish only or chiefly the Coniferæ. High summer temperature and abundant summer rains, are, unquestionably, the conditions necessary to produce the deciduous forest trees. Western coasts, in high latitudes, have the necessary moisture, but not the high summer temperature; Western prairies, east of the Mississippi, and the vast deserts west of it, have summer heat but not moisture; hence the absence of all trees in one region, and of the deciduous trees in the other. In this country, we have probably all the conditions, except time, under which the Canadian timber has been produced.

All the hardy trees belonging to the Canadian Exhibition are capitally shown, by the production of both "rounds," or transverse sections, and planks, so that the grain may be examined in each direction; and we only do justice to the Canadian Commissioners when we point out the skill of their arrangements; not forgetting their excellent Catalogue, which has afforded us some part of the information now laid before our readers.—*Gardeners' Chronicle, June 14th.*

Board of Arts and Manufactures

FOR UPPER CANADA.

ENTRIES FOR THE PROVINCIAL EXHIBITION.

Manufacturers and others, interested in the coming Provincial Exhibition, will bear in mind that Monday, September 22nd, is the day appointed for its opening. We republish, for the information of intending exhibitors, the regulations for making entries and delivering articles for exhibition :—

Reg. 6—*Horses, Cattle, Sheep, Swine, Poultry.*— Entries in these classes must be made, by forwarding the entry form, as above mentioned, filled up, and member's subscription enclosed, on or before Saturday, August 16th, five weeks preceding the show.

Reg. 8—*Grain, Field Roots, and other Farm Products, Agricultural Implements, Machinery, and Manufactures generally*, must be entered previous to or on Saturday, August 30th, three weeks preceding the show.

Reg. 9—*Horticultural Products, Ladies' Work, the Fine Arts, &c.*, may be entered up to Saturday, Sept. 13th, one clear week preceding the show.

Reg. 10—*Exhibitors are particularly requested to take notice that it is essential that the entries be made at the dates above mentioned. It is intended to prepare a Catalogue of a portion of the Exhibition, and this cannot be done unless the entries are made in time.* Therefore, after these dates for the respective classes, no entry

will be received. The entry paper and subscription money will be returned to any person forwarding them.

Reg. 17—All articles for exhibition must be on the grounds on Monday, September 22nd, except live stock, which must be there not later then Tuesday, 23rd, at noon. Exhibitors of machinery and other heavy articles, are requested to have them on the grounds as far as possible during the week preceding the show.

In addition to the prizes published in the April No. of *The Journal*, the following prizes are offered:

MUSIC.

The following prizes are offered for Instrumental Bands:—

For the best Canadian Amateur Band consisting of not less than eight performers, of whom there shall not be more than two professional artists	$60 00
2nd do. do. do.	40 00
3rd do. do. do.	20 00

Each Band will be required to execute the following pieces of music, viz.:—The National Anthem; Rule Britannia; a Quick Step; Waltz; Song; Polka; Set of Quadrilles, and a Medley or Operatic Piece; and to be on the grounds under the direction of the Committee during the continuance of the exhibition. Bands intending to compete will communicate their intention to the Secretary of the Association at Toronto, at least a week before the exhibition commences. The Bands will be required to be on the ground on Thursday and Friday.

CIRCULAR TO MECHANICS' INSTITUTES.

The following circular has been addressed to the Secretaries of the different Mechanics' Institutes in Upper Canada:

Toronto, August 6th, 1862.

Sir,

The undersigned have been appointed, by the Council of the Association, a Committee to secure competent Judges in the Arts and Manufactures Department of the Provincial Exhibition, to be held in the City of Toronto, commencing on Tuesday, the 27th day of September, next.

The plan adopted three years ago, and which has been found to work very satisfactorily, is again proposed to be carried out, namely: to apply to Mechanics' Institutes to nominate certain of their Members, or others, to act as Judges in different Classes of this Department; particularly desiring that, in the first place, efficient men may be selected; and secondly, such as will attend to the duty. The Committee of your Institute is therefore respectfully requested to nominate not more than four persons, the same being non-Exhibitors, and transmit their names to the Secretary by the first of September next; specifying also the Classes in which the parties nominated respectively consent to act. From the lists thus furnished the selections will be made, and the result, so far as your Institute is concerned, will be communicated to you, and the parties selected, forthwith.

The amount of remuneration allowed by the Association to each of the Judges toward meeting expenses, is four dollars.

The following is a list of the classes for which Judges are required:—

ARTS, MANUFACTURES, LADIES' WORK, &c., &c.

Class 38—Cabinet Ware and other Wood Manufactures.
" 39—Carriages and Sleighs, and parts thereof.
" 40—Chemical Manufactures and Preparations.
" 41—Decorative and Useful Arts; Drawings and Designs.
" 42—Fine Arts.
" 43—Groceries and Provisions.
" 44—Ladies' Work.
" 45—Machinery, Castings, and Tools.
" 46—Metal Work, (Miscellaneous,) including Stoves.
" 47—Miscellaneous, including Pottery, & Indian Work.
" 48—Musical Instruments.
" 49—Natural History.
" 50—Paper, Printing, and Bookbinding.
" 51—Saddle, Engine Hose, and Trunk-makers' Work; and Leather.
" 52—Shoe and Bootmakers' Work; and Leather.
" 53—Woollen, Flax, and Cotton Goods; and Furs, and Wearing Apparel.
" 54—Foreign Manufactures.

We are, Sir,

Yours respectfully,

J. Beattie, Jr., *Pres. B. of Arts & M.*

W. Craigie, M.D., *Vice-President.*

W. Edwards, *Secretary.*

BRITISH PUBLICATIONS FOR JUNE.

Adams (W. Bridges) Roads and Rails and their Sequences, Physical and Moral, p. 8vo	£0	10	6	*Chapman & H.*
Adams (W. H. D.) Men at the Helm, Biographical Sketches of Great English Statesmen, fp. 8vo	0	3	6	*Hogg.*
Aikin (Dr.) Arts of Life, 18mo, red. to	0	1	0	*Griffin.*
Bartlett (W. H.) Nile Boat; or, Glimpses of the Land of Egypt, 5th edit., cr. 8vo	0	7	6	*Bohn.*
Bigg (H, H.) Mechanical Appliances necessary for Treat. of Deformities, Part 2, p. 8vo	0	4	6	*Churchill.*
Bleachers (Hints to) containing Rem. on the Sys. of Bleach. and Fin. Linen Goods, 18mo	0	2	6	*Longman.*
Coins of England (The), with their value in Foreign Money, sheet	0	1	0	*Griffith and Far.*
De Porquet (L. P. F.) For. and Eng. Ready Reckoner of Monies, Weights, &c. 6 e. 12mo	0	2	6	*Simpkin.*
Dresser (C.) Art of Decorative Design, with cold. plates, roy. 8vo	1	1	0	*Day and Son.*
Fowler (Rev. R.) Solutions of Questions in Mixed Mathematics, 8vo	0	3	6	*Longman.*
Galbraith (Rev. J.) and Haughton (Rev. S.) Manual of Mechanics, 6th ed., fp. 8vo. sd. 3*s*	0	3	6	*Longman.*
Hale (Rt.) Handbook of Elementary Drawing, chiefly for the Use of Teachers, cr. 4to	0	5	0	*Longman.*
Hudson (T. Percy) Elementary Trigonometry, with a collection of Examples, fcap. 8vo	0	3	6	*Deighton and Co.*
Jeffrys (Jno. Gwyn) British Conchology, Vol. 1, Land and Freshwater Shells, cr. 8vo	0	12	0	*Van Voorst.*
Jobson (Fred.) Australia; with notes on Egypt, Ceylon, &c., 2nd ed., revised, cr. 8vo	0	6	0	*Hamilton.*
Lewes (Geo. Hen.) Studies in Animal Life, cr. 8vo	0	5	0	*Smith and Elder.*
Pfeiffer (Mad. Ida) Visit to the H. Land, Egypt, & Italy, post 8vo, red to	0	3	6	*Ward and Lock.*
Pre-Adamite Man; or the Story of our Old Planet and its Inhabitants, 4th edit., 8vo	0	10	0	*Nisbet.*
Robinson, (J. C.) Italian Sculpture of the Middle Ages, &c., roy. 8vo	0	7	6	*Chapman and Hall.*
Salmon (George) on the Analytic Geometry of Three Dimensions, 8vo	0	12	0	*Hodges and Smith.*
Templeton (Wm.) Engineer's, Milwright's, and Machinist's Practical Assistant, 18mo	0	2	6	*Lockwood.*
Turner (Thomas) Land Measurer's Ready Reckoner, new edit., 8vo	0	5	6	*Whittaker.*
Tytler (A. F.) Elements of General History, Ancient and Modern, new edit., roy. 32mo	0	3	6	*Simpkin.*
Walker (Wm. Jun.) Memoirs of Distinguished Men of Science of Great Britain, of 1807-8, 8vo	0	7	6	*Walker and Son.*
Walsh (J. H., "Stonehenge") The Horse in the Stable and the Field, 4th thousand, 8vo	0	18	0	*Routledge.*

AMERICAN PUBLICATIONS FOR JULY.

Agassiz.—Contributions to the Natural History of the United States of America, vol. 4, 4to. Plates	$12 00	*Little, Brown & Co.*
Bacon.—The works of Francis Bacon, vol. 4, 8vo	1 50	*Brown & Taggard.*
Mussey.—Health; its Friends and its Foes, 12mo	1 00	*Gould & Lincoln.*

Notices of Books.

THE ART OF ILLUMINATING, AS PRACTISED IN EUROPE FROM THE EARLIEST TIMES. *Illustrated by Borders, Initial Letters and Alphabets. Selected and Chromo-lithographed by W. R. Tymms, with an Essay and Instructions by M. D. Wyatt, Architect, London: Published April 2nd,* 1860, *by G. Day & Son, Lithographers to the Queen. Quarto.*

The reader who opens this volume is instantly struck with the variety, symmetry, and exquisite colouring of the illuminations. The beautiful plates with which this work is adorned, supply us with numerous and sometimes most elaborate examples of the Art of Illuminating, throughout a period extending over one thousand years, or from the 6th to the 16th century. The illustrations are taken from Canons, Missals, Books of the Sacrament, the Holy Bible, Coronation Books of the Anglo-Saxon Kings, "Sacramentaries," Decretals, Chronicles, Choral Books, Psalters, and a few Miscellaneous Works.

Most of the above works are in manuscript, and preserved in the different public libraries of Europe, or in the private collections of the rich and noble.

The subjects of illustration are Initial Letters, Borders, Corners, Figures, Title Pages, &c.

This beautiful and valuable work cannot fail to be acceptable to those engaged in many of the

Decorative Arts. It will always be accessible, with a number of other works of a similar character, to visitors to the Library of the Board of Arts and Manufactures for U. C.

A TREATISE ON THE STEAM ENGINE, IN ITS VARIOUS APPLICATIONS TO MINES, MILLS, STEAM NAVIGATION, RAILWAYS AND AGRICULTURE: *with Theoretical Investigations respecting the Motive Power of Heat, and the proper Proportions of Steam Engines; Elaborate Tables of the Right Dimensions of every part, and Practical Instructions for the Manufacture and Management of every Species of Steam Engine in actual use. By John Bourne. Being the Fifth Edition of " A Treatise on the Steam Engine." By the " Artizan Club." Illustrated with* 37 *Plates, and* 546 *Wood Cuts. London. Longman, Green & Co.* 1861. *Quarto.*

The long title of this work, coupled with the name of the writer, is almost sufficient to satisfy every practical Engineer of its value, as a work of reference. It is, however, a work of considerable interest, beyond mere mechanical details and diagrams, for it contains a vast amount of interesting and useful information respecting the history of the Steam Engine in its different forms: the results obtained by paddle wheel and screw steamers, different kinds of locomotives, pumping engines; indeed, of every form in which steam is applied by machinery to motive purposes. The plates are very well executed, and sufficiently large for practical purposes. In the chapter on the Scientific Principles of the Steam Engine, Gravity, Magnetism, Heat, Nature and Laws of Motion, are discussed at length, and form a capital treatise on Mechanical Philosophy. In the chapter on " Investigation of the Laws and Limits of the Motive Power of Heat," the higher mathematics are used, which place its study beyond many readers, but the results obtained by pure mathematics are very intelligibly given, and illustrations numerous. The Tables at the end of the work are very complete, as well as the Rules and Tables for finding the proper proportions of Steam Engines.

THE PRACTICAL MECHANIC'S JOURNAL. *Complete Series. Vol. I to VI. Quarto. London: Longman.*

The Library of the Board is now supplied with the complete series of this excellent periodical. The monthly numbers of the present year are on the Library Table.

THE PRACTICAL MECHANIC'S JOURNAL RECORD OF THE GREAT EXHIBITION OF 1862. *Parts I, II, and III.*

The value of the work consists in its publishers having secured the services of able men to write the different articles describing the wonderful collection of works of nature and art which constitute the different sections of the Great Exhibition of 1862.

If we turn to Cotton, Wool or Silk, we find the article describing the different forms in which these materials are presented to the public gaze, prepared by P. L. Simmonds, F.S.A., F.R.G.S. The article on Flax, by Professor Hodges. On Paper Materials, by W. Stone, F.S.A. On Agricultural Implements, by the well known John Wilson, F.R.S.E., &c.

These articles are not limited to a mere description of what is visible in the Great Exhibition, but they enter into the history, the mode of preparation, the uses, and condition of the art or manufacture or production in the different countries where the subject under review is an important source of national advantage, or has special claims to notice.

Professor Warrington W. Smyth, M.A., F.R.S., who wrote the article on Mineral Products, says of Canada:—" Very complete in all her exhibition, Canada, through the Geological Survey, has forwarded unusually fine examples of Copper Ores, chiefly variegated copper, and pyrites, some of them from mines now in operation, others from localities waiting for development."

This Record of the Great Exhibition of 1862 will be of great value when completed, as furnishing an immense amount of reliable information on the industries of the world.

Patent Laws and Inventions.

ABRIDGED SPECIFICATION OF BRITISH PATENTS.

3058. J. & W. N. BAILEY. *Improvements in apparatus for indicating the pressure of steam and gases, the amount of vacuum, the flow of fluids, the weight of materials, and the speed of bodies either revolving or traversing, and also the employment of of aluminium or its alloys in the manufacture of the same.* Dated Dec. 6, 1861,

In one of these arrangements of steam pressure and weight guages the patentees use a knife edge crank or pivot attached to a weight or its equivalent so as to act as a lever. They use the ordinary india rubber or metalic diaphragm acting against a piston in the usual way. The piston and weight are connected together by a link, having at the bottom a semicircular bearing upon which the knife edged pivot rests, so that, when the piston rises or falls, the pivot will have a delicate motion on the bearing of the link and thereby cause but little friction. The invention comprises much other detail, which we cannot give space to here.

3069. R. JOLLEY. *An improved apparatus for heating, cooling, or drying, infusing, extracting, or absorbing vapours or gases, for manufacturing, medical, or domestic purposes, and for preserving*

liquids and solids alimentary or otherwise. Dated Dec. 7, 1861.

This apparatus is made with double or single doors, lids, and covers to shut air-tight, and is wholly constructed upon air-tight and non-conducting principals, with valves to let air in or out, as may be required. In its manufacture the patentee uses a new combination of fibrous, pulpy, and water-proof materials, for preventing the transmission of heat, cold, air, or moisture.

3135. A. V. Newton. *An improved arrangement of fire-escape.* (A communication.) Dated Dec. 13, 1861.

This consists in the use of a flexible or chain ladder applied to a building so that it may be folded in a tilting box, and in case of fire be released in a moment either by an inmate of the dwelling or a person at the outside, and the ladder allowed to descend to the earth, and form a ready means of escape. Also in combining with the flexible or chain ladder an alarm, so arranged that it will be sounded simultaneously with the liberating of the ladder.

3162. R. Shaw. *Certain improvements in carding engines.* Dated. Dec. 17, 1861.

This consists in the use of an endless band or web of open wire work, lattice or woven fabric continously traversing beneath the carding cylinders and used as a creeper for conveying any loose cotton or other fibrous material falling from the cylinders whilst being carded back again to the "licker in."

3202. G. T. Bousfield. *Improvements in machinery for attaching the soles of boots and shoes to the upper leathers.* (A communication.) Dated Dec. 20, 1861.

This consists in a machine which when placed upon the edge of the sole after it is temporarily secured to the last upon which the upper leather is stretched, will on being struck by the blow of the hammer of the operator, make a hole for the reception of a peg, drive a peg through the sole and and upper leather, move itself along so as to be in position for a repetition of the operation, and feed up the peg wood so as to bring another peg into the proper position to be split off and driven. The invention is not described in detail apart from the drawings.

Canadian Items.

SALE OF PUBLIC LANDS IN UPPER CANADA IN 1861.*

Crown Lands.

At the commencement of the year 1861, there were 1,853,121 acres of Crown Lands on hand in Upper Canada, and 456,842 acres were added by surveys of the waste lands; from which substract the quantity sold, 257,933½ acres, and granted gratuitously on Colonization Roads, 30,800 acres, there remained 2,021,229½ acres disposable at its close.

*Report of the Commissioner of Crown Lands for 1861.

The purchase money of the lands sold during the year amounted to $338,153.88; the gross amount of collections, $276,170.10.

Clergy Lands.

There were 74,366 acres sold, the purchase money of which was $184,674.37. The gross amount of the receipts during the year was $298,-129.24, the commissions and refunds $60,099.20, leaving the net proceeds $238,030.04, for appropriation under the provisions of the Clergy Reserves Act. There are 124,608¾ acres of these lands yet undisposed of.

Grammar School Lands.

5,729 acres of the 60,412 acres disposable on the 1st of January, 1861, were sold for $8,527.79, leaving a balance of 54,683 acres for future sale. The gross receipts of the year were $22,050.74, the commission $4,372.13, and the net proceeds $17,678.61.

Common School Lands.

The sales of the lands amounted to 4,498⅝ acres during the past year, leaving only 12,016½ acres of the million set apart, under the authority of the Act 12th Vic. cap. 200 on hand.

The purchase money of the lands sold amounts to $14,580, the gross collections to $111,514.25, commission, refunds and other disbursements to $22 380.47, leaving a net income of $88,683.78.

The total net amount realized from these lands to 31st December, 1861, is $744,640.44.

CANADIAN MINES AND MINERALS.

Under the new system adopted and detailed in the report of last year presented to the Legislature, many explorations for minerals have been made. Some of the mines already opened have been worked during the year; but the American difficulties have affected this as other branches of trade. There can be no doubt that the copper ore on the Canadian side of the Lakes is equal to that on the southern side. What is wanted is capital, and increased means of communication and facilities for the transport of passengers and goods. These latter will follow, of course, the increase of business, but it is of great importance to Canadian interests that they should receive every reasonable encouragement, and that the wants of the mining district should be supplied from Canada rather than from the United States.—*Ibid.*

ARTIFICIAL OYSTER BEDS IN THE GULF OF ST. LAWRENCE.

The Commissioner of Crown Lands says in his report of 1861 that the experiment (begun in 1859) of transplanting oysters from beds in the waters of New Brunswick, having proved upon examination to give promise of success, it was this fall continued. Those laid down in Gaspé basin during the autumn of 1859, were examined and found to be not only in a good state of preservation, but growing and having every appearance of reproduction. At the trifling expense of $242.80, 300 bushels of carefully picked oysters from the banks at Carraquette, were planted about the same localities. Although the Legislature has made a liberal allowance for testing the possibility of raising oysters along our coasts, the utmost care and strictest economy have been observed in using the money so provided.

COMPARATIVE METEOROLOGICAL REGISTER FOR THE YEARS 1855, '56, '57, '58, '59, '60, & '61.

Provincial Magnetical Observatory, Toronto, Canada West.

LATITUDE, 43° 39′ 3″ North; LONGITUDE, 5h. 17m. 33s. West.—Elev. above Lake Ontario, 108 Feet; approx. Elev. above the Sea, 342 Feet.

	Year 1861.	Year 1860.	Year 1859.	Year 1858.	Year 1857.	Year 1856.	Year 1855.
Mean temperature	44.22°	44.32°	44.19°	44 74°	42.73°	42.16°	43.96°
Difference from average (22 years)	+ 0.10	+ 0.20	+ 0.07	+ 0.62	— 1.39	— 1.96	— 0.16
Thermic anomaly (Lat. 43° 40′ N.)	— 6.78	— 6.68	— 6.81	— 6.26	— 8.27	— 8.84	— 7.04
Highest temperature	87.8	88.0	88.0	90.2	88.2	96.6	92.8
Lowest temperature	—20.8	— 8.5	—26.5	— 7.3	—20.1	—18.7	—25.4
Monthly and annual ranges	108.6	96.5	114.5	97.5	108.3	115.3	118.2
Mean daily range	14.42	14.24	13.66	13 84	16.38	18.29	18.19
Greatest daily range	33.3	30.7	39.8	31.2	37.0	44.2	39.4
Mean height of barometer	29.6008	29.5923	29.6209	29.6267	29.6054	29.5999	29 6249
Difference from average (18 years)	—.0125	—.0210	+.0076	+.0134	.0079	—.0134	+.0116
Highest barometer	30 330	30.267	30.392	30.408	30.361	30.480	30.552
Lowest barometer	28.644	28 838	28.286	28.849	28.452	28.459	28 459
Monthly and annual ranges	1.686	1.429	2.106	1.559	1.909	2.021	2.093
Mean humidity of the air	.78	.77	.74	.73	.79	.75	.77
Mean elasticity of aqueous vapour	.262	.260	.249	.259	.254	.244	.263
Mean of cloudiness	.62	.60	.61	.60	.60	.57	.60
Resultant direction of the wind	N 56 W	N 60 W	N 61 W	N 41 W	N 74 W	N 71 W	N 62 W
" velocity of the wind	2.11	3.32	2 24	1.59	2.54	3.03	2.51
Mean velocity (miles per hour)	7.47	8.55	8.17	7.64	7.99	8.31	8.14
Difference from average (14 years)	+0.70	+1.78	+1.40	+0.87	+1.22	+1.54	+1.37
Total amount of rain	26.995	23.434	33.274	28.051	33 205	21.505	31.650
Difference from average (21 & 22 yrs.)	—3.329	—6.890	+2.950	—2.273	+2.881	—8.819	+1.326
Number of days rain	136	130	127	131	134	99	103
Total amount of snow	74.8	45.6	64.9	45.4	73.8	65.5	99.0
Difference from average (19 years)	+13.17	—16.03	+ 3.27	—16.23	+12.17	+ 3.87	+37.37
Number of days snow	76	75	87	67	79	69	64
Number of fair days	165	174	169	178	171	198	198
Number of auroras observed	43	58	53	59	26	35	46
Possible to see aurora (No. of nights)	180	190	199	198	189	212	204
Number of thunder-storms	27	30	30	19	28	25	38

PROSPECTS OF CANADIAN COPPER MINING ON LAKE HURON.

The *Mining Journal* Correspondent at the Wellington Mines, Lake Huron, (West Canada Co.,) reports in June last as follows:—

"For the present month we hope to turn out a larger pile of clean ore than we did for the month of May. On the 11th inst. we shipped 1,362 barrels of copper ore, making the third cargo for the season; and we are now tramming another cargo, to be ready by the time the steamboats come this way."

As copper is now rising in price these results are gratifying.

In 1846, the copper mines of Lake Superior yielded only £160 worth of copper. Last year they yielded copper worth £600,000.

Selected Articles.

SALINES OR BRINE SPRINGS OF THE VALLEY OF THE KANAWHA. *

(From the Report of Professor George H. Cook.) *

That portion of the valley of the Kanawha in which the Salines are situated lies in the lower coal measures. The river meanders through an alluvial bottom of half a mile to a mile in width, and this is bounded on either side by hills which rise to the height of three to eight hundred feet above the level of the river. These hills are composed of successive beds of porous sandstone, sandy shale and seams of coal, having all a gentle dip to the northwest. The distance along the river where salt springs are known to occur, or where salt wells have been bored, is about ten or twelve miles. The width of the bottom alluvial belt does not appear to affect the production or value of the brines, though the greater number of wells are on the north side, where the the bottom is narrow, and those on the side where it is broader are for the most part near the margin of the river.

* In the superintendent's Report for 1847 is a communication from Thomas Spencer, Esq., on the Kanawha salines. He describes these works as being "upon the navigable waters of the Great Kanawha river, fifty miles from its junction with the Ohio, two hundred miles below Wheeling. The average strength of the brine is about 32 per cent. of saturation, while that of our salines is 73. The works are located along the banks of the river on either side, for a distance of eight or ten miles. and on either side of the river, and parallel to it, about half a mile distant. are lofty mountains. which contain an inexhaustible quantity of bituminous mineral coal, which is used as a fuel at the salt works. It costs, delivered at the works, about three cents a bushel; twenty-eight bushels is estimated to the ton. For each bushel of coal consumed, the manufacturer receives in return nearly a bushel of salt. Each manufactory has its own salt well, which is obtained by boring in solid rock to a depth varying in different wells from 1,200 to 1.800 feet.

In boring several wells for brine to supply the works highest up the river, veins of gas were struck, which rushed up through the apperture with such violence as to blow the rods used for boring several hundred feet into the river. It also brought with it a copious supply of brine. The owners of these wells have availed themselves of these accidental circumstances, and applied them to good account, as it saves them the entire expense of pumping brine and supplying fuel. The gas and brine are separated by a simple contrivance, the latter being conducted into capacious reservoirs, and the former into the flues or "furnaces" of their salt works, where, being ignited, it produces an intense heat, exceeding that caused by the combustion of mineral coal."

During the past season Prof James Hall, State Geologist, visited these works, and procured for me the specimens of salt, brine, &c., which are referred to in the table of analysis. He also furnished me with memoranda for the various details of the manufacture, which are given below, and with the following letter on the geology of that district.

The first discoveries of salt water were in springs or licks upon the surface, and from these was obtained the salt used by the earlier settlers. They were, indeed, known to the Aborigines who inhabited the country before its settlement by the whites. In the earlier attempts in the manufacture of salt, the wells were sunk no lower than the solid rock, the depth of alluvium being from twenty to thirty feet. Subsequently borings were carried into the rock, and finally to the depth of fifteen hundred feet or more. It has been found, however, by experience, that the strength of the water does not increase in descending below 700 or 800 feet, but that below this carburetted hydrogen, which often accompanies the brines, increases in quantity. The evolution of this gas from some of the wells was early turned to account in evaporating the water by its combustion, and many wells were bored to greater depth solely to obtain a larger supply of the gas. At the present time, however, it is regarded as of little consequence, and its use almost discontinued. The deeper boring required, and the liability of accidents to the tubes, attendant upon its evolution beneath the kettles, cause it to be regarded as of no absolute value.

The borings of these wells reveal to some extent the character of the strata beneath the surface, and which would be doubtless better studied in their outcrops farther east.

1. Alluvial formation of variable thickness.
2. Hard black slate, mixed with thin seams of coal and coaly matter, 200 to 300 feet.
3. Described as a hard blue rock, sometimes mixed with sandstone, and sometimes sandstone with layers of hard rock; this extends to four or five hundred feet from the surface.
4. Sandstone, usually friable, white on being drawn out, but becoming red on exposure to the atmosphere. This rock is variable in thickness, and often found extending from five to eight hundred feet from the surface.
5. A hard, flinty rock, the particles fine and sharp like flint, thirty to sixty feet thick. This rock, in some of the wells, is one hundred to one hundred and fifty feet thick.
6. A soft, tough, shaly rock, often called "soapstone," and is named the "*long-running rock,*" from its containing little silex, and the drill runs a long time without becoming dull. This rock commences at about the depth of 900 feet or a little deeper, at the lower part of the salines, from the dip in that direction. The deepest borings have not passed through this rock, although some of the borings have penetrated it at least six hundred feet.

The brines never increase in strength or quantity after entering this rock, and it may be considered as the impervious floor of the saline accumulation.

All the evidence which we have goes to prove very conclusively the absence of beds of rock salt in the neighborhood. The origin of the brines is therefore to be sought in some other source. The porous sandstone strata forming the coal measures many of which were deposited in shallow ocean waters, undoubtedly retained, as all marine sedimentary rocks do, a portion of chloride of sodium. The percolation of surface water through all the superincumbent beds, has carried down this saline matter in solution to the point where it has found

an impervious stratum, where it remains, saturating the porous sandstones and filling the fissures of the surrounding beds. We cannot doubt but the source of these brines is in these carboniferous beds, and that it is widely disseminated in them, and only separated by the slow process of solution by the percolating waters from above.

The lowest point to which the brine increases in strength or quantity, would appear to be at the base of the coal measures themselves, and the hard flinty or silicious stratum may very well represent the conglomerate below the coal, while the shaly beds below the "*long-running rock*" are the fine-grained sandstones and shales which lie beneath this rock.

No rock of an age anterior to the carboniferous period rises to the surface for many miles around the salines of Kanawha.

In boring these wells, they generally go down from 300 to 600 feet, with a bore of from $3\frac{1}{2}$ to 3 inches, and below that to any depth with a smaller bore. The upper part of the boring, for perhaps 250 feet, is then reamed out to a size of from 5 to 8 inches in diameter, and fitted with a corner tube, which is screwed together in joints 25 feet long. At the bottom of this tube the suction or draw-box is to be placed. Before setting it, however, a bag filled with flax seed and tallow is fixed and packed at the point where 3-inch bore ends, from 400 to 600 feet below the surface. A hole from 1 to $1\frac{1}{2}$ inches diameter if then made through this bag, and a tube of the same size passed through it. This tube extends from below the bag of grease and flax seed up to the suction or draw-box. The object of this bag of packing is to swell and fill the opening, so that any fresh water which collects about the tubes above it may not descend and weaken the salt water below. Whenever a well yields too much weak brine, the tubing is taken out, the large opening reamed deeper, and the tubing with the bag reinserted.

The simple boring of a well 800 or 900 feet deep, exclusive of the cost of engine, &c., costs $1,500. These wells yield from 10 to 30 gallons per minute. A well giving 20 gallons of brine at 9°* or 10°, is regarded as a good one. The quantity which will be supplied is limited, and when reached will be regular and fixed. Those which are weakest usually yield the largest quantity, which is owing to the intermixture of fresh water from above. It is a general impression, that the quantity of salt is gradually diminishing, though the quantity and quality differ in wells dug within a hundred yards of each other. Some wells, terminating in a very porous stratum, are found to yield water more copiously than others. In some wells the quantity has greatly increased, and in others the strength has improved, as in one bored last year there has been an increase from 8° to $11\frac{1}{4}$.

Three good wells are needed for one furnace; these cost abont $9,000. The cost of a furnace, and all the preparations for a salt works, is about $30,000.

The brine from the pumps is carried into a capacious cistern, located above the level of the boiler of the salt works, so that it may be drawn from one directly into the other. The boiler which is used in concentrating the brine is made in three sections, each 39 feet long, 8 feet wide, and 4 feet deep, which is equal to one boiler of 99 feet long. These sections are connected by large open pipes, below the level of the brine, so that the communication between them is free. When necessary, either one of them may be shut off, and cleaned or repaired while the others are kept in operation. The bottom of the boiler is made of concave cast iron plates, or shallow pans, each 3 feet long and 8 feet wide, cast with proper flanges and grooves, so that eleven of them may be bolted and cemented together for the bottom of a single section. The sides and top of the boiler are made of thick planks, bolted to the bottom and keyed tightly together, The fire is made under the end of the first section, and the flame and heated air passes under the sections in succession, to the chimney at the opposite end. The brine is boiled till it approaches saturation.

Near the boiler are arranged several open wooden vats, or *settling cisterns*, each 100 feet long, 8 feet wide, and 2 feet deep. Running lengthwise through each of these is a a vertical partition, extending from one end almost to the other. These cisterns are filled about 18 inches deep, and are heated by steam from the boiler. This steam is carried in copper pipes which pass the length of the cistern on each side of the partition, and just beneath the surface of the water. These pipes are from 4 to 6 inches in diameter. The settling cisterns, of which there were four in the work described, are arranged so that the brine passes from the first to the second, and so on in succession. If well managed, the brine will be brought to saturation in the last cistern, and will have deposited all its oxide of iron. Following the settling cisterns is a series of others called *graining cisterns*. These are of the same shape and size with the first, and in them the salt is deposited. They are heated by steam pipes like the others, The saturated brine is drawn into the first of them, where a considerable crop of crystals is deposited, it is then drawn by a syphon into the second, and another crop of crystals is deposited, and so on to the last one where but a very light crop is obtained, and where all the bittern collects. In the works of Dr. Hale, where Prof. Hall obtained much of his information, there were six of these graining cisterns. The specimens of salt in the superintendent's office, and referred to in the analysis, and numbered from 1 to 9, are from these cisterns.

The bittern contains scarcely any salt. From 3,000 to 5,000 gallons are thrown away every day. It contains a large quantity of bromine.

The quantity of salt now made at Kanawha, is from $2\frac{1}{2}$ to 3 million bushels a year, and the furnaces and wells now idle, are capable of increasing the product to half a million bushels without any new wells.

At one time, four years since, there were 43 furnaces in eperation, and making about $3\frac{1}{4}$ million bushels annually. But the market was overstocked, and the price of salt fell to 11 or 12 cents a bushel, (50 pounds). By an agreement among the manufacturers, this overproduction is now prevented, and the amount the market will bear is now fairly divided among among the several furnaces. They also agree upon what shall be the price of salt at the works. Some manufacturers find it more profit-

* 25 deg. is saturation.

able to let their furnaces lie idle, and receive their share of the profits, upon the amount of salt they are entitled to make, from those who make more than their proportion. At present 24 furnaces are in operation, and they will make this year 2,800,000 bushels. Salt is worth at the works 16 cents per bushel. The association of manufacturers count it worth 18 cents a bushel, when in barrels of 280 pounds each.

The salt is generally well liked for packing meats Lime is not used in settling the brine; it is considered injurious from experience elsewhere.

The best worked furnaces produce a bushel of salt for a bushel, (70 or 80 poünds) of coal. This is less than the average. Such results will only be produced from water of 9 or 10°.

The general plan of the works at Kanawha, is much like that of the late Calvin Guiteau, Esq., which is described in the superintendents' report for 1845. It is more easily adapted to the Kanawha brines than to those of Onondaga, on account of their being much weaker, and from their not containing any sulphate of lime, which saves their boilers from incrustation or blocking. The brines contain a much larger portion of oxide of iron than ours do, but this does not make a scale; in the boiling brine it collects into little hard pellets like gravel stones, and in the settling cisterns it is deposited as a soft, muddy sediment. It is remarkable that this oxide of iron both in its wet and its dry state, is attracted by the magnet.

The analysis shows that the Kanawha brine contains 9.2 per cent. of solid matter, of which four fifths are salt. Allowing, then, that every hundred pounds of brine to contain 7.4 per cent. of salt, calculation shows that to produce a bushel, 50 pounds, 625 pounds of water must be evaporated. The average yield of salt being 50 pounds for 75 pounds of coal burned, it follows that each pound of coal in burning evaporates 8.3 pounds of water. This is the full value of the coal according to Johnson's experiments; and yet I am assured by those who have visited the works that there is a great waste of fuel, the flame after passing the whole length of the boiler, frequently streaming out at top of the chimney,

A COURSE OF SIX LECTURES

On some of the Chemical Arts, with Reference to their progress between the Two Great Exhibitions of 1861 *and* 1862, *by Dr.* Lyon Playfair, *C. B., F. R. S., Professor of Chemistry in the University of Edinburgh.*

Lecture II.

Distillation of Coal.—Showing how the former Waste Products in the Manufacture of Gas have been Economised. Salts of Ammonia, Benzol, Tar Colours, &c.

I must now make a little recapitulation of our last lecture, and show you the manner in which its waste products are applied to useful purposes. I explained to you that gas was produced by the distillation of coal; that for a long time the thoughts of manufacturers were applied only to the first purposes for which coal was used, namely, the production of the gas; and that all the substances which are accessory products were looked upon in the light of concomitant evils, the tar and water being waste products, which were inconvenient, and to be got rid of by the most ready methods. Long ago, in the seventeenth century, Boyle, wrote an Essay entitled, "Man's Great Ignorance of the Uses of Natural Things; or, that there is no one thing in nature whereof the use to human life is thoroughly understood." This truth of the seventeenth century is still a truism in the nineteenth century, the whole progress of manufacture being merely an illustration of it. Substances which today are the most useless, to-morrow become embraced within the circle of industrial utilities. It is quite true that there is no one substance in nature of which we know all its properties, or all the uses to which it can be applied for the purposes of common life. I take Boyle's old title as the text for our discourse; but I have only time to give it a very limited application, by describing the utilities now derived from tar, although time will not allow me to embrace them all in one lecture.

You will recollect what were the waste products of the coal-gas manufacture. You will find the products of the distillation of coal in the first diagram on the gallery. First, gaseous products were produced, part of which were useful—the diluents and illuminants; part were impurities, and were got rid of by certain processes. Even these impurities are in some cases now applied. After that there was the crude coal oil, which is commonly called tar; and then there was a watery portion which contained salts of ammonia. We, therefore, had the gaseous products, the crude oil or tar, and the watery distillate. All except the gaseous products were regarded as impurities—waste substances which were got rid of, and the getting rid of which was a serious undertaking to the gas manufacturer; and I wish now to show you how all these have been utilised.

We begin with the gas water, the badly-smelling black, ugly gas water of the gas-works, and see what has been obtained from it. The gas water contains salts of ammonia. These salts of ammonia, except in one instance, consist of the base ammonia united with volatile acids, sulphuretted hydrogen, and carbonic acid in the other. A certain quantity of chloride of ammonium, or ammonia in union with hydrochloric acid, is also found in the gas water. The value of these salts of ammonia was long known before they were extracted from the watery waste product of the gas manufacture. In fact, ammonia derives its name from one of the titles given to Jupiter, "Jupiter Ammon," near whose temple in Upper Egypt ammonia was for many generations manufactured from the refuse of camels, which was taken and heated and distilled, and gave off ammonia or some of its salts. Hence its name. Its uses were familiar in this country, and its applications to manufactures were known long before persons thought of extracting it from gas water. After a time chemists found sulphide of ammonium and carbonate of ammonia in the watery portion of the coal gas distillate. This distillate gives a very abundant source of ammoniacal salts, and, in fact, the source from which it is now almost all derived. As, however, the subject of to-day's lecture, when we come to the colours produced from coal-tar, wholly relates to the cha-

racters of ammonia and the base which is in these salts, I must be permitted, with the excuse of the many chemists whom I see present, to tell those who are not necessarily chemists what ammonia is, and what are its peculiar characters.

The general character of ammonia is probably known to you all. Here is a vessel containing it. It is, as you will see, a colourless gas. It has a very pungent smell; it has an alkaline character; and it is extremely soluble in water. Mr. McIvor will now agitate a portion of this with water, and then you will see how soluble it is. Its alkaline character I wish to explain to you for a moment. An alkaline character is the character possessed by certain bases, such as soda and potash, and a trivial feature of it, but a very important one, is that it renders reddened infusions blue. I have got here the alkali soda, and if I add it to a reddened vegetable infusion, you see the reddened vegetable infusion becomes blue. This is an ordinary character, and apparently a trivial matter, but still an important one. Now we will agitate this ammonia with water, in which it is partly soluble, and we will admit the water into it, and you will see how it rises. You will observe, at the same time, that this red matter as it rises becomes blue. It is so exceedingly soluble in water, that the water dissolves the ammoniacal gas; and its alkaline character is shown to you very distinctly by the red colour of this red water becoming strongly blue just as this fixed alkali soda or potash rendered it blue. Observe how extremely soluble this alkaline ammonia is. You see the water absorbs it so completely that we are obliged to add more water in order to fill the tube.

It is the character of an alkali to unite with an acid. An acid with which it forms one of the most economical salts of which I have to speak, is muriatic acid. Here I have some muriatic acid—colourless, like the ammonia, but yet possessing very different properties. You see in this case we have got this water blue instead of red, and we will now remove our vessel and agitate it in the same way. We introduce a little of the water and shake it up, so as to dissolve some of the muriatic acid, which is of a different character altogether from ammonia. And now we pass it back into the basin of water coloured blue. The other was red and became blue; but now the blue becomes red, from this gas being an acid—having an acid instead of an alkaline character.

Now, I wish to show the effect when these two gases are mixed. We must allow a little time for the completion of the experiment. I have here some ammonia, and I will place a flame below it; and in the other retort I have an acid, and I will place a light below that also. This is muriatic acid. When both of these are heated we will bring the vapours into contact. You will see then that the muriatic acid will unite with the ammonia, and produce a substance which is exactly the same, although not in such a solid form, as this muriate of ammonia, [referring to a large white block of that substance on the lecture table.] It is hydrochloric acid and ammonia which form this solid cake in the manner in which it occurs in commerce.

How completely, you will see, this shows the deductive character of chemistry. Chemistry, in its present state, is not an inductive science; it is a deductive science. It is a science taught to us by experiment.

These liquids are now nearly boiling, and we will pass the two gases into this large tube. [The vapours of the ammonia and the hydrochloric acid were passed through separate tubes up into a large glass globe, and there allowed to mix]. They are now joining one another, and they are forming this solid white muriate of ammonia by their union. You see how this solid body is formed from two gases, a result which could not have been predicated by any science, and is only taught to us by experience.

Having explained the preliminary points to you, I now desire to show how salts of ammonia are manufactured in the arts. When a ton of coal is distilled, above ten gallons of the watery portion comes over from it—ten gallons from Newcastle coal. This contains sulphide of ammonium and carbonate of ammonia. Now, sulphuretted hydrogen and carbonic acid are both volatile substances. It is, therefore, only necessary to add a strong acid to obtain whatever salt we please from these compounds of ammonia. Muriate of ammonia is manufactured in this way:—The gas liquor is run into a deep cistern. This cistern is connected with a chimney, and there is poured into it muriatic acid. That muriatic or hydrochloric acid expels the sulphuretted hydrogen and the carbonic acid, and forms muriate of ammonia in solution. The bad-smelling gas, sulphuretted hydrogen, which smells like rotten eggs, is passed up the chimney, and removed from the locality of the works, to be given to people living at a distance. The muriate of ammonia is placed in a pan containing about 1500 gallons, and evaporated till strong enough to crystallise. The muriate of ammonia obtained in this way is impure, and has to be sublimed in order to be obtained in this state. This is a piece taken from the top of the retort. After that it is removed to a still of this kind—an iron pot surrounded by a leaden dome; and here a fire is placed below it, and the muriate of ammonia vaporises from its impurities, and condenses at the top as a crystalline solid. About 4000 tons of this muriate of ammonia are made annually in this country from gas water. It is used extensively in making alum, and it is used largely in the process of soldering. For instance, it is employed for preparing tin plates when you are obliged to get the surface of the iron which you are about to tin in a perfectly clean state. You put it in a bath of muriate of ammonia, which dissolves off the oxides which are on the surface, and leaves the iron in a state for soldering. It is also employed extensively in making the more common salts of ammonia.

There is a point in connection with this to which I would direct your attention. I want to show you the peculiar character of ammonium as a metal. Ammonia consists of one equivalent of nitrogen and three equivalents of hydrogen. There seems to be little analogy between this substance and chloride of sodium or chloride of potassium. Chloride of sodium, which is common salt, contains the silvery metal sodium; and chloride of potassium contains also the silvery metal potassium. There seems to be little analogy between a gaseous body consisting of one of hydrogen and three of ni

trogen ; but I am going to attempt to imprison this body, which consists of four equivalents of hydrogen and one of nitrogen, by amalgamating it with mercury. Here I have a saturated solution of this salt, chloride of ammonium which chemists are compelled to think contains a substance having metallic characters, although it consists of these gaseous bodies, nitrogen and hydrogen. Here I have an amalgam, or a compound of mercury with sodium. Now, if I pour this amalgam of sodium and mercury into the chloride of ammonium, the sodium takes away the chlorine from that compound, and leaves the ammonium to combine with the mercury. This metal is NH_4. It is one of an evanescent character, and I must imprison it by holding it in the mercury in order to show you its presence. As the ammonium acts upon the mercury it will swell up. It is now swelling. You see it growing in bulk before your eyes. We have the ammonium imprisoned by the mercury, and enabling me to show you for awhile that this substance really has metallic properties, although it will soon dissipate again into the gases of which it consists. You see that it has formed an amalgam, as the sodium did, but, from its gaseous character, one of much larger bulk. It is a semi-solid or butyraceous substance. It can be handled, but it soon breakes up into running mercury and the gases. It is now obvious how the salts of ammonium may be readily made analogous to the salts of sodium and potassium. This body, NH_4, or one of nitrogen and four of hydrogen, is in reality a metal which unites with halogens and forms salts.

I must run quickly over the other salts of ammonia, and I will not enter into the details of the manufacture. For instance, this muriate of ammonia is not manufactured only in the way I have told you. It is manufactured in many other ways which it would tire you to describe. One of them is to take the gas water, and, instead of saturating it with strong acids like muriatic acid, to distill it with lime. The ammonia gas goes over, and is very readily condensed in water. It may be condensed in water or acids, and forms various salts. This process is much the best, as the badly smelling sulphuretted hydrogen is retained by the lime. There is another way of manufacturing this muriate of ammonia by acting upon sulphate of ammonia with common salt; but I will not tire you with all these details and modifications of the manufacture. You must ascribe it not to ignorance, but to the fact that I do not think it necessary to enter into them. I now pass to sulphate of ammonium, which is another salt very much manufactured from gas water. About 5000 tons of it are annually made in this country from gas water. It is made in the same way, by adding oil of vitriol to the ammonia of the gas liquid. It is used largely for manure. It is used largely for making alum; and it is employed also for making ammonia, or rather solutions of ammonia in water,—by distilling it with lime, which keeps back the sulphuric acid. Carbonate of ammonia is another salt, and one which ladies use very much in their scent-bottles, and as a diffusive stimulant. It is made by distilling with sulphate of ammonia and chalk. Chalk is carbonate of lime. The carbonic acid goes over to the ammonia and forms carbonate of ammonia. The way this is done in the arts is represented here. I have here a still, or a retort, not at all unlike the retorts which are used in gas making. Here the sulphate of ammonia, or the muriate of ammonia and carbonate of lime are placed, and they are heated together with fires placed under them, and the carbonate of ammonia being a volatile salt, is sublimed and condenses in these chambers. It is afterwards distilled again. It sublimes at 177°, which is below the boiling temperature of water. The stills have got leaden caps, and the water heats the impure salt and sublimes the carbonate of ammonia which is afterwards taken out of the cap. This is also very largely manufactured. About 2,000 tons are made annually of this salt. Various modifications of these plans are also used. For instance, the gaseous ammonia is led into a chamber of carbonic acid. The chamber has water at the bottom The carbonate of ammonia is formed and crystallised, and afterwards sublimed. The aqua-ammonia of pharmacy, or ammonia water, or liquid ammonia, or hartshorn, is made by introducing a base to keep back the acids, and the ammonia is distilled over. This ammonia is used for a great many purposes—as a diffusive stimulant in medicine. It is also used as an antacid in medicine ; and largely employed to saturate carbonate of ammonia in ladies' scent bottles, some aromatic substance being generally mixed with it. Now, look what a transformation is effected by the application of chemical agency: the refuse of camels, the offal of the streets, the fetid water of the gas-works. have become so transformed under the influence of chemistry that ladies preserve them in their scent-bottles as a cherished luxury. You see how these waste products may be used to furnish even luxurious utilities.

(*To be continued.*)

ON ALUMINUM.*

BY J. W. M'GAULEY.

We are on this occasion, specially to treat of a metal which has been a source of great expectations; and, fortunately, there is no reason to consider that these have been disappointed ; their complete realisation is only deferred, and most probably for but a short period ; and one of our objects in directing attention to it, is to excite a more general inquiry regarding it. The establishment of aluminum amoung the most important of the metals is a mere question of the cheapness of its production ; and as, up to this time at least, it is most conveniently obtained by means of sodium, investigations regarding it resolve themselves into a determination of the most economical method of obtaining that metal. On this point our knowledge has also progressed considerably, and hence the price of aluminium has greatly fallen. Not long ago it was 3*l.* per ounce, it is now only about 5s. ; and it will, no doubt, be far less, if we are to judge by the extraordinary improvements always made, after a time in chemical processes. How much lower in price are the most useful substances at present than they were a few years ago, because the methods of manufacturing them have been simplified. But even at its present cost, which by weight, is the

* Abbreviated from the *Chemical News*.

same as that of silver, aluminum is really only one-fourth as dear, bulk for bulk ; and this, after all, is the test, since bulk for bulk, it is as strong, and even stronger than silver. When there is question, however, of its application to domestic purposes, we must compare its cost with that of pewter or copper; it would chiefly supersede these, which, among other disadvantages, are productive of very noxious compounds, particularly the copper.

The qualities of the precious metals are quite distinct from those of the more common ; nor have the two classes hitherto been connected by any intermediate metal—that is, by one possessing the most characteristic properties of each ; but it is hoped that aluminium may supply such a connection. Like the precious metals, it is brilliant, and little alterable by chemical agents—scarcely at all, under ordinary circumstances. Like the common metals it is very abundant, constituting one-fourth, by weight, of the most widely diffused bodies. It is malleable, ductile, hard, and tenacious ; its compounds are harmless—which is true of scarcely any other metal but iron ; and, unlike both the precious and commou metals, it has the advantage of being extremely light. It is admirably suited to all ordinary purpcses, and is one of the best that can be used for those which are artistic and ornamental. M. Christofle, in 1858, exhibited before the Academy of Sciences a group in aluminum, which had been cast and chiseled, and which afforded an excellent example of its capabilities, though it was its first application to such a pnrpose.

When we attempt to get aluminum directly from alumina, with potassium, or sodium, we do not succeed; most likely from its being necessary that the potash or soda, which would then be formed, should unite with some of the undecomposed oxide, which does not seem to occur, though aluminates of the alkalies are very easily made. But M. Chapelle, in 1854, procured it by introducing pulverised clay, sea-salt, and powdered charcoal into a common crucible, and heating the mixture with coke, though not to whiteness, in a reverberatory furnace. When the crucible was cold, a considerable quantity of minute globules of aluminium were found at the bottom. It must be admitted that the simplicity of this method, if it could be rendered economical, would make it deserving of preference ; and it is not improbable that it may hereafter be so improved as to supersede all others. To obtain aluminum through the medium of a troublesome metal seems at best a clumsy process. It is, however, the most successful that has been yet devised ; and we are indebted for it in its present improved state to the ingenuity and researches of Deville, whose method is a modification of Wohler's. He received from the present Emperor Napoleon the funds necessary for making his experiments on a large scale, and in a satisfactory manner, and he first published an account of them in 1854.

It occurred to him that, on account of its smaller equivalent, and the commercial value of its salts, sodium would be better for the purpose of obtaining aluminium than potassium, which had been employed by Wöhler. Other advantages, besides, were found to follow from its adoption. The manufacture of sodium is easier, and even safer, than that of potassium; and when the process goes on well, those carbon compounds which are so annoying with potassium, do not make their appearance, nor is its reduction accompanied by the explosive substances—probably compounds of hydrogen—which are so dangerous in the reduction of potassium. Moreover, the use of potassium in obtaining aluminium is not very safe, it inflames so easily, and often produces such violent explosions; while sodium can be employed without fear, since it may be raised in the atmosphere to a higher temperature than its point of fusion. Indeed, we have reason to believe that it is inflammable only in a state of vapour, though still at a temperature below its boiling-point; and if it is kept very carefully from water, there will be little likelihood of its takiug fire.

To get pure aluminium by Deville's method, we require pure alumina, pure chloride of aluminium and metallic sodium ; for any impurities present in these will be concentrated in the aluminium, and affect its properties very much, nor, if once combined with it, can they ever be entirely removed. We shall first, therefore, describe how these are to be had.

To Obtain Pure Alumina.

Eight and a-half parts, by weight, of the sulphate of alnmina of commerce for every required part, by weight, of pure alumina, are dissolved in an equal weight of water, and precipitated by a concentrated and boiling solution of acetate of lead in slight excess, and the smallest possible quantity of tartaric acid is added to the liquor, which is separated by decantation, to prevent the precipitation of alumina. The acetate of alumina is then supersaturated with ammonia, and the ammoniacal solution, after being treated with hydrosulphuret of ammonia in a closed vessel, is placed in a stove having a temperature of from 122° to 124° F. This determines the precipitation of the sulphurets of iron and lead, which are removed first by decantation, and then by filtering —but without washing the filters. The clear and slightly yellow liquor, which consists of acetate and tartrate of of alumina combined with ammonia, and some hydrosulphuret of ammonia, is rapidly evaporated and carbonised in an earthen crucible. The residual mixture of alumina and carbon is made into a paste with oil, and strongly calcined to expel the sulphur, due to a little sulphuric acid which remains in the alumina, the whole of it not having been separated by the acetate of lead.

To Obtain Pure Chloride of Aluminum.

Some of the mixture of alumina and carbon, just mentioned, is introduced into a porcelain tube that has been fitted with another tube, and is heated to redness in a current of dry chlorine. Chloride of aluminum sublimes, and is removed from the tubes in compact masses, which are composed of very beautiful crystals, that are either colourless or slightly tinged with yellow. If, however, from the impurity of the materials, this chloride is not found to be quite pure, it is heated with nails or iorn turnings, in an earthen or cast-iron vessel, which, when the permanent gases have passed off, is closed ; after, which, the heat being continued, a slight pressure results that causes the chloride of aluminum to melt and come in contact with the iron. This changes the volatile per-

chloride of that metal into the protochloride, which is comparatively fixed, and the chloride of aluminium, completely purified, crystallises in the vessel itself in large transparent and colourless prisms, and a distillation in hydrogen finishes the process.

To Obtain the Sodium.

Its preparation is founded on the reaction of an alkaline carbonate on carbon; and carbonate of soda, wood charcoal, and carbonate of lime are required in the following proportions:

Carbonate of soda	717
Wood Charcoal	175
Chalk	108

The carbonate of soda should be obtained from crystals dried and pulverised fine; the carbon and chalk should also be reduced to powder, and the whole, as soon as possible after having been mixed, should be made into a paste with very dry oil, and then calcined at a red heat in an iron mercury bottle, that it may occupy a small space, and thus a larger quantity of sodium be obtained by the subsequent process. The calcined mass is subjected to a high heat in an iron mercury bottle, which is not so rapidly destroyed as might be expected, and ought to last for three or four operations. It is kept comparatively cool by the resulting oxide of carbon, and by the sodium assuming an aëriform state, and the heat required is not near so great as might be supposed. An iron tube leads from the bottle, which is inside the furnace, to a receiver, which is outside, and has an aperture for the escape of the gases. The carbonic oxide formed from the chalk assists in carrying the vapor of sodium rapidly into the receiver, and thus prevents it from decomposing any of the gas by which it is necessarily surrounded,—an effect that would be facilitated by its finely divided state as vapour. The receiver, also, is thus kept hot enough to unite the metallic globules without a wasteful after process. One-seventh of the weight of the mixture which has been used, or one fourth cf the weight of the carbonate of soda, should be obtained in sodium. If the mixture employed has been such as to melt, it will have prevented a free disengagement of the gases.

To Obtain the Aluminum.

From 3,000 to 5,000 grains of chloride of aluminium are placed in a tube of glass or porcelain, about one and a-half inches of interior diameter, and are insulated by two plugs of asbestus. Hydrogen, purified and dried by being transmitted through sulphuric acid and chloride of calcium, is sent through the tube; and while it is passing, the chloride of aluminum is gently heated by a few coals, to drive away any hydrochloric acid which may have been formed by the action of the air on the chloride, and also the chlorides of sulphur and silicium which are invariably present in small quantities. Sodium previously crushed between two pieces of dry filtering paper, and placed in a boat, is then introduced into one end of the tube while it is still full of hydrogen, and is melted. The chloride is at the same time heated so as to make it rise in vapour, that it may come in contact with the sodium, and be decomposed; and when the sodium has disappeared, and the chloride of sodium that has been formed is saturated with chloride of aluminum, the process is complete. An incandescence which occurs is easily regulated. The boat being taken from the tube, the mixed chlorides, in which the globules of aluminium are suspended, are removed by dissolving in water, and the globules, covered up in a porcelain crucible either with mixed chlorides of aluminum and sodium or with common salt, are fused together by a strong heat.

This process answers still better on the large scale; but, instead of the porcelain tube and boat, two cast iron cylinders connected by a smaller tube of iron are employed. The anterior cylinder contains the chloride of aluminium; the posterior, sodium in a tray; and the iron tube, kept at a temperature of from 400° to 500° F., scraps of iron to separate any of that metal which may rise with the vapour of chloride of aluminum, by changing it from volatile per- to fixed proto-chloride.

Œrsted, who was the first to form chloride of aluminum, is said to have obtained that metal by heating the chloride with an amalgam of potassium rich in the latter, and driving off the mercury from the resulting amalgam of alumnium by heat.

Aluminium may also be procured from cryolite, a mineral which exists abundantly in Greenland, though it is found only in small quantites elsewhere.

ON FORCE.*

The existence of the International Exhibition suggested to our Honorary Secretary the idea of devoting the Friday evenings after Easter of the present year to discourses on the various agencies on which the material strength of England is based. He wished to make iron, coal, cotton, and kindred matters, the subject of these discourses; opening the series by a discourse on the Great Exhibition itself; and he wished me to finish the series by a discourse on "Force" in general. For some months I thought over the subject at intervals, and had devised a plan of dealing with it; but three weeks ago I was induced to swerve from this plan, for reasons which shall be made known towards the conclusion of the discourse.

We all have ideas more or less distinct regarding force; we know in a general way what muscular force means, and each of us would less willingly accept a blow from a pugilist than have his ears boxed by a lady. But these general ideas are not now sufficient for us; we must learn how to express numerically the exact mechanical value of the two blows; this is the first point to be cleared up.

A sphere of lead weighing 1lb. was suspended at a height of 16 feet above the theatre floor. It was liberated and fell by gravity. The weight required exactly a second to fall to the earth from that elevation; and the instant before it touched the earth, it had a velocity of 32 feet a second. That is to say, if at that instant the earth were annihilated, and its attraction annulled, the weight would proceed through space at the uniform velocity of 32 feet a second.

Suppose that instead of being pulled downward by gravity, the weight is cast upward in opposition to the force of gravity, with what velocity must it

* Lecture by Prof. Tyndall at the Royal Institution, June 6th, 1862.

start from the earth's surface in order to reach a height of 16 feet? With a velocity of 32 feet a second. This velocity imparted to the weight by the human arm, or by any other mechanical means, would carry the weight up to the precise height from which it has fallen.

Now the lifting of the weight may be regarded as so much mechanical work. I might place a ladder against a wall, and carry the weight up a height of 16 feet; or I might draw it up to this height by means of a string and pulley, or I might suddenly jerk it up to a height of 16 feet. The amount of work done in all these cases, as far as the raising of the weight is concerned, would be absolutely the same. The absolute amount of work done depends solely upon two things: first of all, on the quantity of matter that is lifted; and secondly, on the height to which it is lifted. If you call the quantity or mass of matter m, and the height through which it is lifted h, then the product of m into h, or mh, expresses the amount of work done.

Supposing, now, that instead of imparting a velocity of 32 feet a second to the weight we impart twice this speed, or 64 feet a second. To what height will the weight rise? You might be disposed to answer, "To twice the height;" but this would be quite incorrect. Both theory and experiment inform us that the weight would rise to four times the height: instead of twice 16, or 32 feet, it would reach four times 16, or 64 feet. So also, if we treble the starting velocity, the weight would reach nine times the height; if we quadruple the speed at starting, we attain sixteen times the height. Thus, with a velocity of 128 feet a second at starting, the weight would attain an elevation of 256 feet. Supposing we augment the velocity of starting seven times, we should raise the weight to 49 times the height, or to an elevation of 784 feet.

Now the work done—or, as it is sometimes called, the mechanical effect—as before explained, is proportional to the height, and as a double velocity gives four times the height, a treble velocity nine times the height, and so on, it is perfectly plain that the mechanical effect increases as the square of the velocity. If the mass of the body be represented by the letter m, and its velocity by v, then the mechanical effect would be represented by $m\,v^2$. In the case considered, I have supposed the weight to be cast upward, being opposed in its upward flight by the resistance of gravity; but the same holds true if I send the projectile into water, mud, earth, timber, or other resisting material. If, for example, you double the velocity, of a cannon-ball, you quadruple its mechanical effect. Hence the importance of augmenting the velocity of a projectile, and hence the philosophy of Sir William Armstrong in using a 50lb. charge of powder in his recent striking experiments.

The measure then of mechanical effect is the mass of the body multiplied by the square of its velocity.

Now in firing a ball against a target the projectile, after collision, is often found hissing hot. Mr. Fairbairn informs me that in the experiments at Shoeburyness it is a common thing to see a flash of light, even in broad day, when the ball strikes the target. And if I examine my lead weight after it has fallen from a height I also find it heated. Now here experiment and reasoning lead us to the remarkable law that the amount of heat generated, like the mechanical effect, is proportional to the product of the mass into the square of the velocity. Double your mass, other things being equal, and you double your amount of heat; double your velocity, other things remaining equal, and you quadruple your amount of heat. Here then we have common mechanical motion destroyed and heat produced. I take this violin bow and draw it across this string. You hear the sound. That sound is due to motion imparted to the air, and to produce that motion a certain portion of the muscular force of my arm must be expended. We may here correctly say, that the mechanical force of my arm is converted into music. And in a similar way we say that the impeded motion of our descending weight, or the arrested cannon ball, is converted into heat. The mode of motion changes, but it still continues motion; the motion of the mass is converted into a motion of the atoms of the mass; and these small motions, communicated to the nerves, produces the sensation which we call heat. We, moreover, know the amount of heat which a given amount of mechanical force can develop. Our lead ball, for example, in falling to the earth, generated a quantity of heat sufficient to raise the temperature of its own mass to three-fifths of a Fahrenheit degree. It reached the earth with a velocity of 32 feet a second, and 40 times this velocity would be a small one for a rifle bullet; multiplying three-fifths by the square of forty, we find that the amount of heat depeloped by collision with the target would, if wholly concentrated in the lead, raise its temperature 960 degrees. This would be more than sufficient to fuse the lead. In reality, however, the heat developed is divided between the lead and the body against which it strikes; nevertheless, it would be worth while to pay attention to this point, and to ascertain whether rifle bullets do not, under some circumstances, show signs of fusion.

From the motion of sensible masses, by gravity and other means, the speaker passed to the motion of atoms towards each other by chemical affinity. A collodion balloon filled with a mixture of chlorine and hydrogen was hung in the focus of a parabolic mirror, and in the focus of a second mirror, 20 feet distant, a strong electric light was suddenly generated; the instant the light fell upon the balloon, the atoms within it fell together with explosion, and hydro-chloric acid was the result. The burning of charcoal in oxygen was an old experiment, but it had now a significance beyond what it used to have; we now regard the act of combination on the part of the atoms of oxygen and coal exactly as we regard the clashing of a falling weight against the earth. And the heat produced in both cases is referable to a common cause. This glowing diamond, which burns in oxygen as a star of white light, glows and burns in consequence of the falling of the atoms of oxygen against it. And could we measure the velocity of the atoms when they clash, and could we find their number and weight, multiplying the mass of each atom by the square of its velocity, and, adding all together, we should get a number representing the exact amount of heat developed by the union of the oxygen and carbon.

Thus far we have regarded the heat developed by the clashing of sensible masses and of atoms. Work is expended in giving motion to these atoms or masses, and heat is developed. But we reverse this process daily, and by the expenditure of heat execute work. We can raise a weight by heat; and in this agent we possess an enormous store of mechanical power. This pound of coal, which I hold in my hand, produces by its combination with oxygen an amount of heat which, if mechanically applied, would suffice to raise a weight of 100 lbs. to a height of 20 miles above the earth's surface. Conversely, 100 lbs. falling from a height of 20 miles, and striking against the earth, would generate an amount of heat equal to that developed by the combustion of a pound of coal. Wherever work is done by heat, heat disappears. A gun which fires a ball is less heated than one which fires blank cartridge. The quantity of heat communicated to the boiler of a working steam-engine is greater than which could be obtained from the recondensation of the steam after it had done its work; and the amount of work performed is the exact equivalent of the amount of heat lost. Mr. Smyth informed us in his interesting discourse that we dig annually 84 millions of tons of coal from our pits. The amount of mechanical force represented by this quantity of coal seems perfectly fabulous. The combustion of a single pound of coal, supposing it to take place in a minute, would be equivalent to the work of 300 horses; and if we suppose 108 millions of horses working day and night with unimpaired strength, for a year, their united energies would enable them to perform an amount of work just equivalent to that which the annual produce of our coal-fields would be able to accomplish.

Comparing the energy of the force with which oxygen and carbon unite together, with ordinary gravity, the chemical affinity seems almost infinite. But let us give gravity fair play; let us permit it to act throughout its entire range. Place a body at such a distance from the earth that the attraction of the earth is barely sensible, and let it fall to the earth from this distance. It would reach the earth with a final velocity of 36,747 feet in a second; and on collision with the earth the body would generate about twice the amount of heat generated by the combustion of an equal weight of coal. We have stated that by falling through a space of 16 feet our lead bullet would be heated three-fifths of a degree; but a body falling from an infinite distance has already used up 1,299,999 parts out of 1,300,000 of the earth's pulling power, when it has arrived within 16 feet of the surface; on this space only $\frac{1}{1300000}$ths of the whole force is exerted.

Let us now turn our thoughts for a moment from the earth towards the sun. The researches of Sir John Herschel and M. Pouillett have informed us of the annual expenditure of the sun as regards heat; and by an easy calculation we ascertain the precise amount of the expenditure which falls to the share of our planet. Out of 2,300 million parts of light and heat the earth receives one. The whole heat emitted by the sun in a minute would be competent to boil 12,000 millions of cubic miles of ice-cold water. How is this enormous loss made good? Whence is the sun's heat derived, and by what means is it maintained? No combustion, no chemical affinity with which we are acquainted would be competent to produce the temperature of the sun's surface. Besides, were the sun a burning body merely, its light and heat would assuredly speedily come to an end. Supposing it to be a solid globe of coal, its combustion would only cover 4,600 years of expenditure. In this short time it would burn itself out. What agency then can produce the temperature and maintain the outlay? We have already regarded the case of a body falling from a great distance towards the earth, and found that the heat generated by its collision would be twice that produced by the combustion of an equal weight of coal. How much greater must be the heat developed by a body falling towards the sun! The maximum velocity with which a body can strike the earth is about 7 miles in a second; the maximum velocity with which it can strike the sun is 390 miles in a second. And as the heat developed by the collision is proportional to the square of the velocity destroyed, an asteroid falling into the sun with the above velocity would generate about 10,000 times the quantity of heat generated by the combustion of an asteroid of coal of the same weight. Have we any reason to believe that such bodies exist in space, and that they may be raining down upon the sun? The meteorites flashing through the air are small planetary bodies, drawn by the earth's attraction, and entering our atmosphere with planetary velocity. By friction against the air, they are raised to incandescence and caused to emit light and heat. At certain seasons of the year they shower down upon us in great numbers. In Boston 240,000 of them were observed in nine hours. There is no reason to suppose that the planetary system is limited to "vast masses of enormous weight," there is every reason to believe that space is stocked with smaller masses, which obey the same laws as the larger ones. That lenticular envelope which surrounds the sun, and which is known to astronomers as the Zodiacal light, is probably a crowd of meteors; and moving as they do in a resisting medium they must continually approach the sun. Falling into it, they would be competent to produce the heat observed, and this would constitute a source from which the annual loss of heat would be made good. The sun according to this hypothesis, would be continually growing larger; but how much larger? Were our moon to fall into the sun it would develope an amount of heat sufficient to cover one or two years' loss; and where our earth to fall into the sun, a century's loss would be made good. Still our moon and our earth, if distributed over the surface of the sun, would utterly vanish from perception. Indeed, the quantity of matter competent to produce the necessary effect would, during the range of history, produce no appreciable augmentation in the sun's magnitude. The augmentation of the sun's attractive force would be more appreciable. However this hypothesis may fare as a representant of what is going on in nature, it certainly shows how a sun might be formed and maintained by the application of known thermodynamic principles.

Our earth moves in its orbit with a velocity of 68,040 miles an hour. Were this motion stopped, an amount of heat would be developed sufficient to raise the temperature of a globe of lead of the same size as the earth 384,000 degrees of the cen-

tigrade thermometer. It has been prophesied that "the elements shall melt with fervent heat." The earth's own motion embraces the conditions of fulfilment; stop that motion, and the greater part, if not the whole, of her mass would be reduced to vapour. If the earth fell into the sun, the amount of heat developed by the shock would be equal to that developed by the combustion of 6,435 earths of solid coal.

(To be concluded in our next.)

Miscellaneous.

MITCHELL'S PATENT TYPE-COMPOSING AND DISTRIBUTING MACHINES.

In order thoroughly to demonstrate the practical utility of these machines, they are employed in the International Exhibition, Class 7, B, Machinery Annex, in the actual performance of work for the press; one machine is for composition, and another for distribution.

The "compositor" is in shape a right angled triangle, placed horizontally, with a key board at one of the sides, furnished with thirty-nine keys. Each key when pressed, strikes out a type from one of an equal number of brass slides standing at an incline upon the machine in a row nearly parallel with the key board. The type thus liberated is conveyed upon a band, moving in a direction at right angles with the key-board, to another band (forming the hypothenuse of the triangle) which carries it on to its destination. Arrived here, it is placed on end and pushed forward, to make room for the next type, by means of a notched or serrated wheel called the "setting wheel." The words are thus put together with great rapidity, in a long line of about thirty inches, which is afterwards divided by the compositor into lines of the required length. The principle of the machine consists in the combination of bands of lengths and velocities of revolution so varied as to enable the types, at different distances from the wheel, to reach it in the order in which the keys are struck.

The "compositor" is capable of setting up types at the rate of 6 letters per second, or 21,600 per hour; but as the human fingers cannot attain to such rapidity, and allowance must be made for the operations of "justifying" and "correcting," the work of an average trained operator will probably not exceed 24,000 or 25,000 ens per day, which is about equal to the work of two men setting up type in the ordinary mode. As each machine can employ two operators, the daily production is about 50,000 ens.

The "distributor" is a small machine of circular form. The lines of type to be distributed are placed successively in a long channel, in which they are pressed forward towards a vibrating metal "finger," By this finger each type is separated from the line, pushed aside, and dropped on to a grooved brass wheel revolving horizontally. In the grooves of this wheel pins are placed, on which the types are hung by means of nicks, the ends of the types projecting below the under surface of the wheel at distances varying according to the position of the nicks. As each letter arrives over its receptacle it is lifted off its pin and dropped into its place, being pushed a little forward to make way for the next arrival. When the line is filled in this way it is removed by the boy to the "compositor." The "distributor" is self-acting and requires only the attention of a boy. It distributes 8,000 letters per hour.

Both machines have been successfully used with type ranging in size from great primer to brevier. They have been worked for several years in America, and have been recently introduced into the establishments of some of the most eminent printers in England and Scotland. As compared with the present mode of type-setting, the following advantages are claimed for these machines:—1. An economy of labour varying from 30 to 50 per cent., according to the character of the work. 2. Greater facility in acquiring the printer's art, whilst it renders his occupation comparatively light and healthy. 3. Decrease in the wear of type, and a smaller quantity sufficient for a given amount of work.

COAL AND BRITISH INDUSTRY.

An interesting lecture was lately delivered at the Royal Institution, by Mr. Warington Smyth, "On Coal as one of the great Materials of British Industry," on which occasion the Duke of Northumberland took the chair. After remarking on the great importance of coal, socially and politically, as the chief source of the manufacturing superiority of this country, Mr. Smith proceeded to conider its formation, character, and geological relations. He said that though doubts were at one time entertained whether that hard, black, and heavy mineral substance could have been formed from vegetable matter, these doubts have been entirely removed by the abundant fossil remains of trees and plants found in the shales above and beneath the seams of coal, and in some instances in the coal itself. The "coal measures," or series of strata among which coal occurs, consists of successive layers of sandstones and shales, or indurated clay, intermixed with occasional layers of coal, which vary in thickness from less than the eighth part of an inch to ten or twelve feet; few of those seams of coal that are less than two feet thick being at present worth the expense of working. In the shales above and below the coals are generally numerous fosilised plants of great variety, and Mr. Smyth said that on one occassion, after having visited the fine collection of tropical plants at Chatsworth, he descended into a coal mine, on the roof of which he witnessed a collection of tropical vegetation that even surpassed what he had seen a few hours before in the Duke of Devonshire's conservatories. In the shales underneath thick beds of coal are found abundant remains of a plant called "Sigillaria," which are supposed to be the roots of large trees known as stigmata, many of which are upright as they grew, and their trunks pass through the coal into the shale and sandstone above. These plants, and indeed all the fossil vegetation associated with coal, belong to genera that now grow in tropical climates, though none of the same species are extant. The accumulation of vegetable matter at the present day in peat bogs, Mr. Smyth observed, may be regarded as an illustration of the manner in which masses of vegetation were collect-

ed during the period of the coal formation, and which it must be supposed were subsequently converted into coal by the action of heat and superincumbent pressure. The fact that large fossil trees, apparently springing from the roots below the seams of coal, penetrate into the rocks above, indicates the rapid deposition of the sand and clay above the vegetable matter, for the strata must have been deposited before the still distinctly vegetable organisation was decomposed. The stems of trees which thus pass through the shales above the coal are not unfrequently the cause of fatal accidents in coal mines, for when the coal has been extracted, the upper parts of the fossil stems having lost their support, fall into the passages of the mine, and the men who are working below are severely injured. Mr. Smyth stated, that in one of the coal mines he inspected the fossil stems of the trees had fallen from the roof in many places, and he saw several still there that might fall at any moment. The relative extents of the coal districts in England, Wales and Scotland were marked on a large map; but as Mr. Smyth observed, the superficial area gives a very imperfect idea of the quantity of coal beneath, for the depths of the coal measures vary considerably, and the thickness and value of the seams of coal they contain vary much more. The depth of the Northumberland and Yorkshire coal measures is about 2,000 feet, and the total thickness of the coal in the various seams is fifty feet. The coal measures of Staffordshire are 5,000 feet deep, and they contain a total thickness of 100 feet of coal; while in Westphalia and at Starbruk the coal strata extend to depths of 6,000 and 10,000 feet. In addition to the principal beds of coal which lie above the carboniferous limestone in the geological series of rocks, there are others of much less thickness and of minor importance, occasionally found below and among the carboniferous limestone, sometimes in the secondary strata, and more abundently in the tertiary formations. The latter kind of coal is often called wood-coal, as it is of a brown colour, and not perfectly mineralised, and it contains very distinct indications of its vegetable origin. It is a remarkable fact that the character of the vegetation of the wood-coal found in Germany closely agrees with the vegetation of North America, and not with that of Europe, from which Mr. Smith inferred that at no very distant geological period Europe and America were united, for it is not probable that the vegetable matter could have floated across the Atlantic and been deposited in Germany. It is from such facts as this that geology is enabled to throw light on the geography of former worlds.—*London Mechanics' Magazine.*

SAFE WORKING PRESSURE OF BOILERS, AND HOOPING OF FLUES.

From the last Monthly Report of Mr. L. E. Fletcher, the Engineer of the Manchester Association for the Prevention of Steam Boiler Explosions.

For some time since I have been desirous of touching upon the point of Safe Working Pressures for boilers, since it not unfrequently happens that it is necessary to warn our members, on account of excess.

The scale adopted by the Association as a general standard is as follows:—For shells of boilers 7 feet in diameter, made of $\frac{3}{8}$th plate, the safe working pressure is 50lb.; if of $\frac{7}{16}$th plate, 60lb.; and other dimensions in proportion. This allowance corresponds with the general practice of the manufacturing engineers of the district, is quite as high as the standard in other parts of the country, and considerably in excess of that permitted either in France, Holland, or Belgium, by their respective governments. It must, however, be distinctly understood that this standard should not be applied arbitrarily in every case, without any allowance being made for the attendant circumstances. It is only applicable in cases where the boiler is well made, both as regards materials and workmanship, and where the condition of the plates is good. It would be highly dangerous to apply it to boilers weakened by the wear and tear of years; while, on the other hand, a new and thoroughly well made boiler might for a time be allowed to work at a pressure slightly in excess of that given. But this could only be safe where everything is in first-rate condition.

It is a very common idea that the bursting pressure of a boiler is six times as high as that given above as its safe working pressure. This, however, I am persuaded is a great mistake, and leads in many cases to undue confidence. I am confirmed in this conclusion by the constant examination of the rent plates in boilers that have exploded, where I find that, even where explosion results from thinning of the plates rupture ensues long before they are reduced to one-sixth of their original thickness, and in one case I knew a well made and nearly new boiler, in first-rate condition, to explode, on account of only a comparatively slight increase of pressure, which had accidentally been allowed through an error in the steam guage. In this case, that at which the boiler actually burst did not exceed its ordinary working pressure by more than 50 per cent., the one being about 90lbs., the other about 60lbs. I believe that an application of anything like six times the pressure given in the scale above would burst most of the boilers in Lancashire, and where it has been actually attempted by hydraulic pressure, the steam domes have been found to tear off long before the strain referred to has been attained. I cannot, therefore, think that shells of cylindrical boilers can be worked without risk at a higher pressure than that given in the preceding scale, unless under very exceptional circumstances.

With regard to the furnace tubes which are exposed to external pressure, I am glad to find that the practice is becoming increasingly general of strengthening them either with flanged seams or hoops, the hoops being made either of angle iron, T iron, or other approved form; and since it too frequently happens that flues are not made in the first instance truly cylindrical, on which their strength so much depends, and that other sources of weakness creep into the manufacture unawares, it is extremely desirable that no new boiler should be constructed with flues unstrengthened in the way just described, however slight the working pressure may be.

These hoops are frequently added to boilers after their first construction, and since some of our members have suffered inconvenience from the imperfect manner in which they have been fixed, I may state

the method found by experience to be the best, which is as follows:—The hoops, if made in two halves, may be passed in through the manhole, and can then be secured to the furnace tubes when in position. They should not, however, be brought in direct contact with the plates of the tube, but should have ferrules of about an inch thick placed between the two, so as to leave a clear space all round through which the water can circulate. Where this space has been omitted, the plates have been found in some places to crack at the rivet holes, and in others to blister and buckle, in consequence of which many plates have had to be cut out and the hoops removed, from which the system of hooping has been in some cases unfairly condemned. Where, however, the ferrules have been introduced and the water space allowed, no injury has been found to arise to the plates even over the hottest part of the fire. The rivets uniting the hoops to the furnace tube should pass through these ferrules, and be spaced about six inches apart, while the two halves of the hoops should be connected together by butt strips rivetted to their ends at the back. When hoops are applied as an after-clap in this way, angle iron is preferable to T iron, as the flange, being narrower, is less liable to cause overheating of the plate. It may be necessary to vary the size of the angle iron in some cases, but, generally speaking, one three inches in the flange and half an inch in thickness will be found to answer every purpose. It is sometimes the practice to put two angle irons back to back. This is quite unnecessary, and a single one is all that is required. A drawing, to show the arrangement recommended, has been made for the assistance of the members, and can be seen on application at the offices of the Association.

Since writing the above, I have met with some additional cases, where considerable expense has been incurred by having to remove angle iron hoops from furnace tubes, in consequence of the injudicious mode in which they have been fixed, and would therefore impress upon our members the importance of attention to the above, if they wish to prevent the recurrence of disappointment in their own case.

Boring and Winding Machinery.

The advantage of careful exploration by boring previous to making a large outlay in mining operations is generally admitted, but there has hitherto been great difficulty in obtaining a cheap and economic machine. Mr. John Paton, of Govan Bar Ironworks, Glasgow, has, however, succeeded in removing the cause of complaint; he now manufactures a machine, by the use of which the expense of boring is reduced to less than one half of the usual cost. The apparatus has been successfully employed to the depth of 150 fathoms, in the course of which the tools have passed through strata of the hardest nature. Even at this depth the rods and boring-tool were lifted, and wrought with the utmost ease and without strain upon the small engine employed. The services of two men and a boy being all, or indeed more, than is required to carry on the work with speed and efficiency. The rate at which the boring is effected, as well as the extreme facility with which the rods are raised, and the pump lowered to clear the bore, enables the workmen to accomplish a very large amount of work in a given time, as compared with the old system. It is found in practice that one machine will do the work of ten or twelve men. The mechanical arrangement is extremely simple. Upon the foundation frame of the machine is arranged a small engine, which gives motion to the shaft. On the shaft, at the end nearest to the engine is fitted a pinion, which is preferred to be ot the angularly-grooved frictional class; this pinion imparts motion to the grooved wheel, which is keyed to the transverse shaft. In fitting this shaft, its journals are arranged eccentrically in the bearings, which are carried in the pillars of the framing, one of the bearings is made to project sufficiently to admit of the eye of the hand lever being passed on to it and attached thereto, With this arrangement, when the hand lever is raised the shaft is lowered sufficiently to throw the wheel out of gear with the pinion on the shaft, which comes down on a break-block beneath. It is by means of the wheel that the necessary vertical, intermittent, or jumping motion is imparted to the boring-tool. In two of the arms of the wheel are formed radial slots, in which are fitted the adjustable studs carrying the anti-friction rollers. The studs project inwardly from the face of the wheel, so that as the wheel rotates the rollers alternately come in contact with and depress the end of the lever. This lever is fast to a short horizontal shaft, the bearings of which are carried on the upper part of the framing. To the shaft is keyed a second lever, to the free overhanging extremity of which is suspended a swivel, and the brae-head or hand-wheel, for giving a rotatory motion to the boring-rods and the boring-tool at the lower end of the series. The weight of the of the rods on the lever is counteracted to the required extent by an arrangement of a counterweight used in conjunction, if required, with a hydrostatic or pneumatic cylinder. On the foundation frame are arranged the pedestal bearings of the transverse shaft, which has fast to it a lever connected by a chain to the counterweight' In front of the framing is fitted a spring buffer apparatus, which serves to modify the force of the blows, more particularly when a new boring-tool is brought into use, and it is required to make the blows comparatively light. The foundation frame supports the lofty frame, to the cross-beam of which are hung two pulleys; over one of these the chain for lifting the rods is passed, and over the other the wire-rope for lowering and raising the pump. The arrangement of the frame is to facilitate the raising of the rods, to save time and avoid taking the rods apart, except in lengths of 30ft; and the frame is made of a height to admit of the rod being disconnected in such lengths. The shaft has running upon it the drum or barrel, which is put into and out of gear with the wheel by means of a coupling-clutch, actuated by a hand lever. This drum is used for the wire rope for raising and lowering the pump, to afford the necessary convenience for cleaning the bore when required. The rotatory movement of the drum is checked and regulated by a friction strap which is tightened by the handle. The boring-rods are raised and lowered, and other winding operations performed, by means of a chain wound upon a secondary barrel, actuated from the first motion shaft. This shaft has upon it a second frictional pinion,

which gives motion to the wheel on the shaft; the journals of this shaft are arranged eccentrically in their bearings, as before described in referring to the shaft. In this way, by means of a hand-lever, the wheel may be instantly put in or out of gear with the pinion. The shaft has fast to it the winding-barrel, on which the rope or chain for effecting the winding operations is wound. With these arrangements either of the winding barrels may be brought into operation as required, or remain quiescent, whilst the wheel is operating the lever and the boring-tool. When the hole has become so choked with the fragments that it would impede the action of the borer, the rods are raised with the greatest facility, and separated in lengths of 27 to 30 feet each; the whole is then cleared with the pump attached to a wire rope, and the rods are replaced, the entire operation occupying but a very few minutes. Mr. Paton's machinery is well worthy of the attention of those requiring boring machinery. A large drawing of this machine is hung in the Machinery Department of the International Exhibition, as suffiicient space could not be given for exhibiting the machine itself.

A Large Steam-Hammer.

The following particulars relative to a 15-ton steam hammer (probable the largest in the world) cannot fail to interest many of our readers. It has been constructed by Messrs. R. Morrison and Co., Ouseburn, Newcastle-on-Tyne, for their own use, under Mr. R. Morrison's first patent. It is single-acting and worked by hand, and is similar to a 10-ton hammer made by the same firm for the Elswick Ordinance Works. The cylinder is 46 in. diameter with a clear fall or stroke of 8½ft.; the hammer is forged of the best scrap iron, in one solid piece with the piston and dovetail end for receiving the face, and is finished to 18 in. diameter—its total length being 27 ft. 6 in. The cylinder with its covers and glands, weighs 32 tons; the hammer-bar, 15 tons; the two frames, 34 tons; the anvil-bloc,k bed-plate, and sockets for crane post and bottom foundation-plates, 120 tons: making in all 210 tons. The cylinder is strongly flanged and ribbed, and is securely bolted between the frames by forty-eight bolts, 2½ in. diameter each, thus securing the cylinder and frames together in one solid mass perfectly rigid; and the whole is held down by eight foundation-bolts, each 4 inches square, passing through strong cast iron plates 14 ft. below the surface. The foundation for carrying the whole is composed of concrete, timber, and stonework, and is 44 feet one way, 26 feet the other and 14 ft deep. The frames are cast hollow, measuring 4 feet one way, 3feet 6 inches the other and 2½ inches thick. One of these frames contains the valve and gear for working the hammer, as well as the steam and exhaust pipes; so that there is nothing projecting on the outside to interfere with the workmen or the cranes. The principal features of this hammer are its simplicity, durability, and efficiency. The space around the hammer is such that the workmen go about their work with the greatest facility; the height from the surface of the ground to the underside of the frames is 11 feet 3 inches, so that the largest piece of work that can be got under the hammer can be turned round in every way without being taken from under the hammer; and the moving mass of the hammer itself being of malleable iron, and in one solid piece prevents the possibility of breaking. The length of the cylinder over the top and bottom covers which form the guides is 14 feet; so that whatever may be the size of the forging under the hammer the bar is always guided for the length of 14 feet. The hammer is arranged for the heaviest class of forgings required by engineers or ship builders, such as large crank-axles, screw-frames, and armour plates; and it thus supplies a want which has been considerably felt for this heavy class of work. Some experimental armour-plates of large size have already been forged by it, besides other heavy jobs.

Cheap and Effective Pump.

In the western annexe, between the two great pumps exhibited by Messrs. Gwynne and Co., and Messrs. Easton and Amos respectively, is a small yet not less effective machine, with which our readers are not altogether unacquainted; we allude to the chain-pump of Mr J. U. Bastier. The pump exhibited has a tube of 4⅜-inch bore, and is worked by a 2-horse power engine only, yet raises with the greatest facility from 450 to 500 gallons of water per minute, the pulley revolving at the rate of from 80 to 84 turns per minute. The entire space occupied by the pump does not exceed 4ft. by 1½ ft., and this space would be sufficient for pumping from the deepest mine. Since the first introduction of the chain-pump by Mr. Deprony, some 70 years since, it has been acknowledged that the chain-pump offers many advantages, but it is only recently that anything like perfection has been reached. The washers employed by Mr. Deprony, as a packing for the discs, which, as is well known, are provided at short intervals along the entire length of the endless chain, were of leather, which, hardening in the water, caused a large amount of friction upon the interior of the tubes, and these tubes, again, being of the same diameter from the bottom to the top of the column, a considerable proportion both of water and of motive-power was wasted. Since that time India-rubber has come into more extensive use, and Mr. J. U. Bastier has been fortunate enough to hit upon the idea of reviving Mr. Deprony's principle, with the addition of improvement, which brings it as nearly as possible to perfection. For the flat disc employed by Mr. Deprony he substitutes a small cylindrical piston of gutta-percha; for the leather washer he substitutes washers of strong India-rubber; and lastly, instead of a tube of uniform bore, he employs a tube more contracted at one part than another, the effect being to make each disc act as a piston whilst passing the narrow part of the tube. The pump acts as a force-pump, or as a suction-pump, according to the depth of the water in which it is immersed. It acts as a force-pump when the level of the water to be pumped exceeds 40 in., for then as, by the well known laws of hydrostatics, the water will rise in the interior of the tube to the same level as on the exterior, the disc entering the tube will force the water already in the tube before it. But should the water in which the pump tube is immersed be less than a yard in depth, the suction principle comes into play; in this case the disc entering the tube after moving upwards about 4 in. (for we should say

that the bottom of the tube is trumpet-shaped, to facilitate the flow of the water), reaches the contracted portion of the tube, and draws the water after it, ready to be forced onward by the following disc. It will be seen that in this compressed space the discs becoming packed by the slight compression of the India-rubber, play the part of a piston, the suction and forcing going as long as motion is given to the pulley over which the endless chain passes, such pulley being fixed on an axle, made to rotate either by a driving band and steam-power, or any other motor. Mr. Bastier's pump has attracted much attention since the opening of the Exhibition, and we understand the inventor has already received orders for all quarters of the globe. We have never seen an equal quantity of water raised by a pump with a tube of equal diameter, and, therefore, unhesitatingly direct it to the attention of all using pumping machinery. The power of the pump may be increased to any extent, since the greater the speed of the pulley the greater is the number of the discs which pass through the tube, and the greater the quantity of water raised. the power of the pump, however, is not its only recommendation; the space it occupies in the shaft is extremely small, and as the descending part of the chain counterbalances the rising portion, balance-bobs and all similar contrivances are unnecessary. A framework of wood or iron supports the axle upon which the disc pulley is fixed, the strength, of course, depending upon the depth from which the water is to be pumped, and the weight of the tubes, whilst the action of the pump is regulated by an adequate fly-wheel. In addition to the improvements above referred to, the different forms of disc, the substitution of India- rubber washers for leather, and the contracted tube, we may mention that the upper disc-pulley is provided with indentations into which the discc fall; they are thus kept always uninjured, whilst the motion of the chain is smooth and uninterrupted ; aud at the lower end of the pump-tube a small wooden pulley, placed slightly behind the tube, is provided, which guides the chain and discs into the mouth of the tube.

Impregnable Locks.

That such eminent locksmiths as Hobbs and Co., would be represented at the International Exhibition would, of course, be anticipated, and that they would exhibit something extraordinary would likewise be expected. There will be no disappointment in either particular. A little to the west of Bessemer's steel trophy, in the south-eastern transept, and just upon entering the hardware department, Messrs. Hobbs and Co's collection will be found. The locks are of first-class workmanship, and well illustrate the perfection to which the locksmiths art can be brought. The variety exhibited is great, and each form of locks has doubtless its attractions, whether it be a machine-made common lock (a class of fastenings which Messrs. Hobbs and Co. manufacture to a great nicety) a protector, or an indicator lock, but the changeable key bank lock is a master piece; it is justly described to be unaproachable as a security of the repositories of treasure, and impregnable against every practicable method of picking, fraud, or violence. The "bits" or steps on the "web" of the key, that act on the levers inside the lock, are separate, instead of being, as in other keys, cut on the solid metal. These moveable "bits" are fastened by a small screw on the end of the shank of the key, when it has the appearance of any other lever lock key. There are, besides, spare "bits" to change when desirable. The lock has three sets of levers, and is so constructed that, whatever arrangement the "bits" on the key may have when acting on the lock, the latter immediately adapts itself to the arrangement, and will lock and unlock with perfect facility; but it cannot be unlocked by any of the "bits" except that which locked it. The great advantage of this arrangement is that a banker can defy even the maker of the lock to open it, and in the event of any suspicion that the key has been fraudulently copied he can change it in a couple of minutes, and have all the advantage of a new lock; and as a lock with eight "bits" would admit of some 40,320 changes, it will be apparent that the greatest possible security is ensured. By simply increasing the number of "bits" the changes may be increased *ad libitum*, though for all practical purposes half-a-dozen "bits" giving, 720 changes, would probably be deemed ample. Ten "bits" would give no less than 3,628,800 changes, yet so simple in the arrangement of the lock that but little extra expence would be incurred in manufacturing a lock to make the changes of which it would be capable occupy a century. Messrs Hobbs and Co's locks have received prizes in almost every instance in which they have competed, and an inspection of them will give convincing proof that they have deserved them.

Age of the Gold Fields of Nova Scotia.

A paper was read last month by the Rev. Dr. Honeyman, "On the geology of the Gold Fields of of Nova Scotia," before the Royal Geological Society. The strata passed through from Laidlaw's and Allan's farms to Mount Uniacke, and thence onward in the same direction were described, the paper being prefaced by an interesting sketch of the history of the discovery and working of gold in the province. In the course of the discussion which followed, Sir. W. Logan said that he believed the the granites of Nova Scotia to be of Devonian age; they had the same in Canada. In Canada it was certainly of newer age than that which they gave to the gold-bearing rocks; this formation is traceable through Maine to New Brunswick, and thence westward. They had found gold in Canada, and at the International Exhibition they had now two nuggets, weighing respectively 8 and 4 ozs. He would be glad if Dr. Honeyman could tell them whether chrome iron has been found in the gold-bearing rocks of Nova Scotia, because he had observed that it was usually found in rocks of that character.—Sir. R. Murchison thought that gold was seldom found in great or even appreciable quantities except in the Lower Silurian rocks; he might say between the bottom of the Lower Silurian and the end of the palæzoic. Dr Honeyman said that he had received the specimens of serpentine from Dr. Dawson, and they were said to have been got from that region. He did not know that there was any chrome iron; the gold principally occurred in the chloritic slates.—The President said it was contended that the gold-bearing drifts were derived

from Lower Silurian strata; but the question was were they spread out over countries where the Lower Silurian did not occur?—Sir William Logan thought the drifts were, no doubt, derived from the Lower Silurian.—The president was bound to admit that there was much in the hypothesis that gold is found in the Lower Silurian formation, and there might be something to be learnt in connection with them from the hypothesis propounded by the author of "Ore in Mineral Veins."

The third paper by Mr. J. W. Salter, comprising notes on some fossil crustacea from the lower coal measures of Nova Scotia, on Eurypterus, and on some Tracks of Crustacea in the Lower Silurian Rocks, was of an exceedingly interesting character but as it was profusely illustrated a satisfactory abstract is scarcely possible. An interesting discussion followed, at the conclusion of which the President observed that some of the speakers had appearently somewhat misunderstood Darwin's hypothesis, which he considered supposed change but not necessarily progression.—The meeting then separated.

Factories and Factory Workers.

A return has been made respecting the cotton, woolen, worsted, flax, hemp, jute, hosiery, and silk factories in the United Kingdom, subject to the factories Acts. It shows a number no less than 6,378, with 36,450,028 spindles and 490,866 power looms, and motive power equal to 375,294 steam and 29,339 water. 775,534 persons are employed in these factories, 308,273 males and 467,261 females; 69,593 are children under 13, about half boys and half girls. Taking the cotton factories, we find that in 1850 they were returned 1932 in number, with 20,977,017 spindles, 248,627 power looms, and 82,555 motive horse power; but the cotton factories now are 2887 in number with 30,387,467spindles, 399,992 power looms, and 294,130 horse power. The people employed in the cotton factories in 1850 were but 333,924; they are now 451,569. The males under 13 have increased in this interval from 9,482 to 22,081; and the females under 13 from 5,511 to 17,707; of the workers above 13, the males have increased from 132,019 to 160,475, and the females from 183,912, to 251,306. So that in the period since 1850, according to returns laid before Parliament then and now, the motive horse power in the cotton factories is described as having increased no less than 256 per cent., which is very much faster than the increase either in raw cotton imported or cotton goods exported; the persons employed increased only 36 per cent.; but the number of those under 13,163 per cent.

Curious Railway Experiment.

Another discovery threatens to change our railway plant perhaps our railway system. M. Girard, under the patronage of the Emperor, has constructed an experimental railway, on which the carriages are impelled after the manner of a sledge. The runners of the sledges rest on a species of hollow clogs, between which and the rails water is introduced. Thus the carriages slide on a thin layer of water, and friction is almost annihilated. The success of the experimental railway is stated to be so decided that the Emperor has appointed a commission to report on the system.—*Athenæum.*

The Colony of Victoria.

The colony of Victoria excited great interest for its gold in the Exhibition of 1851, being at that time only a dependency of New South Wales, and having a population of 77,000 inhabitants. It has since become an independent colony, and has now a population of 540,000. It appeared from the Custom-house returns that the export of gold in 1851 amounted to 145,000 ounces—equal to £580,000; whilst in 1860 it was 2,156,000 ounces—equal to £8,626,000; and the aggregate of the export in ten years was 24,000,000 ounces—equal to upwards of £95,000,000. In addition to this, there was an amount which did not appear in the returns, estimated at 2,000,000,ounces more, so that the whole export was 26,000,000 ounces—equal to £103,941 000. There were now 46 thriving towns. In 1851 there were 39 places of public worship, against 874 at the present time; 30 institutions for charitable relief, and a flourishing university. There were 860 schools, with 52,000 scholars; a public library of more than 30,000 volumes, with 117,000 readers in nine months. In the exhibition of 1851 there were 37 trades represented in that department, and now there were 236. More than £5,000,000 had been spent in roads and bridges, and £3,000,000 in public buildings. There were 100 miles of Government railway open, and 182 more in course of construction, involving an expenditure of £8,000,000; 15,000 miles of electric telegraph, costing £163,000. Thus it would be seen that, in ten years, greater progress had been made in that colony than would have been the case, under ordinary circumstances, in a century in an old country.

On the Igniting Point of Coal Gas.

In consequence of the recent explosion in Holland, Dr. Frankland has experimented on this subject, and the results arrived at are thus summed up:—1. Coal gas cannot, even under the most favourable circumstances, be inflamed at a temperature below that necessary to render iron very perceptibly red-hot by day-light in a well lighted room. But this temperature is considerably below a red-heat visible in the open air on a dull day. 2. This high igniting point of coal gas, under all circumstances is due in a great measure to the presence of olefiant gas and luminiferous hydrocarbons. 3. The igniting point of explosive mixtures of the gas of coal mines is far higher than that of similar mixtures of coal gas; consequently, degrees of heat which are perfectly safe in coal mines, may ignite coal gas; hence also, the safety-lamp is much less safe in coal gas than in fire-damp. 4. Explosive mixtures of coal gas and air may be inflamed by sparks struck from metal or stone. Thus an explosion may arise from the blow of the tool of a workman against iron or stone, from the tramp of a horse upon pavement, &c., 5. Explosive mixtures of coal gas may also be ignited by a body of a comparatively low temperature, through the medium of a second body, whose igniting point is lower than that of coal gas. Thus sulphur, or substances containing sulphur, may be inflamed far below visible redness; and the contact of iron below a red heat with very inflammable substances, such as cotton waste, may give rise to flame, which will then, of course ignite the gaseous mixture.

Grease and India Rubber.

If some means could be found to prevent the actiou of grease on india rubber, the discovery would be hardly less valuable than that of the vulcanizing process. When india rubber is dissolved in any volatile liquid, such as spirits of turpentine or benzole, the solvent may be expelled by heat, but when it is dissolved in any of the animal or vegetable oils there is no method known by which it may be separated. India rubber is soluble in all the fatty oils, and this property interferes with its use in many places where it would be otherwise exceedingly valuable; for instance, fishermen would wear india rubber overalls in preference to any other material, were it not for the fact that they are soon ruined by the oil of the fish; and india rubber belts have been frequently brought into discredit by the circumstance of a few being injured by their careless exposure to the contact of grease.

We do not regard this field as very promising, for it has been explored by many learned chemists, and it seems to be the nature of india rubber, in all combinations and under all circumstances, to yield to the solvent power of fat; still, in organic chemistry, there is no known limit to the variety of combinations and of results.—*Scientific American.*

The Suez Canal.

The gigantic works in connection with the Suez Canal scheme are being pressed forward with a vigour worthy the undertaking. The Egyptian Government have furnished a great number of hands for the service of the company—In fact, nearly 22,000. It must not be imagined, however, that these comparative slaves will exert themselves as would as many English or French labourers. The intention is to employ, indeed double that number, if they can be got from Egypt. At present the work is almost exclusively concentrated upon the cutting to be made upon the sand heights of El Djiser, and the engineers promise that what they call the *rigole de service*, or elementary canal, shall within the next two months carry the waters of the Mediterranean into the basin of Lake Tismah. This canal, or cutting, as we should prefer calling it, will be about 15 feet wide, and 18 inches deep. Some twenty dredging machines are to be employed in clearing out a channel, which, completed last year, has realized the prophecy of the late Robert Stephenson, and has now become choked by sand. There is no doubt that the company have undertaken a task which it will require all the talent of their engineers and all the muscular force of their 40,000 assistants to accomplish.

The Eye Photographed.

At the meeting of the American Photographical Society last Feburary, Dr. Henry D. Noyes exhibited a negative showing the optic nerve and interior of a rabbit's eye. The impression was obtained by a newly invented instrument devised by himself and Mr. Grunow, a practical optician. Such a photograph has never been obtained before in this country, although it is said to have been done in France. The interior of the eye, namely, the retina and optic nerve, has been disclosed to observation in the living person, by an instrument invented in Germany, called the opthalmoscope. This has been in use for ten years, but it is only now that the interior of the eye has been photographed. Dr. Noyes explained the working and principles of the new opthalmoscope, by the aid of diagrams and the presentation of the instrument itself. Through it diseases of the eye can be studied with greater facility, and scientific records of them kept. The instrument displayed, in its elegant and finished workmanship, the highest mechanical skill. The discourse of the doctor was listened to with close attention, and the audience expressed their approbation by applause.

Canadian Mica.

The value of Mica depends upon the size of the sheets and their transparency; the clear, ruby-tinged being the finest, and the cloudy grey the least valuable. With regard to the mica from British possessions, it appears that the sale of Canadian has been much damaged through the carelessness of those shipping it. The first parcel, of about ¼ ton, which Messrs. Nash and Liénard received was sold at 2s. 1d. per lb.; and the second, of about ¾ ton, realised 2s. Since this the quality has not been kept up; the third parcel, of about 1 ton, required careful sorting after arriving in this country, to render it marketable at all, and then sold one-half at 2s. and the remainder at 7½d., the nett amount cleared and transmitted to Canada being only 144*l.*, or about 1s. 1d. per lb. The same firm has since undertaken to import mica from Calcutta, and the quality is so much superior to that from Canada that the latter is now saleable only at a very low price. The Calcutta mica is indeed, about equal to that from Siberia, and is at present readily saleable at from 2s. 6d. to 4s. per lb. according to quality, and the quantity taken. Owing to varying quality the price of mica varies considerably: Canada mica will range from 3d. to 2s., and Calcutta from 6d. to 4s., per lb.—*Mining Journal.*

Cog-Wheels Superseded.

A new system of transmitting power from a horizontal to a vertical axis, without cog-wheels, is exhibited by Messrs. Fontainemoreau and Gilbre, of Finsbury, in the western annexe. The machine is the invention of Mr. L. Thirion, of Belgium, and consists of a helicoidal spring, having two axes at its two extremities. If these two axes are placed in a relative position with regard to one another, so as to make either a right acute or obtuse angle, and if motion is given to one of them by means of a crank arm, water wheel, or steam-engine, the motion will be transmitted to the other axis without noise or shock, and only with the friction of the bearings. The power transmitted by this means is, therefore, limited only by the strength of the bars composing the springs. The inventor has successfully applied this new power to a windmill having no cog-wheels, and which is composed of a hollow wooden or iron upright, on the top of which is placed a flexible spiral spring with its two axes, one of which passes through the standard and the other rests on a support forming the vane of the mill. By the aid of this invention motive power may be secured continuously, and at a very slight expense.

Artificial Stone.

The *Suffolk Chronicle* contains a notice of the manufacture of artificial stone in large masses, upon a plan lately discovered by Mr. Frederick Ransome, of Ipswich. The composition of the stone is not given, but it appears that the principal binding material is the indestructible silicate of lime. Blocks weighing a ton and a-half may, it is stated, be completely solidified and hardened in the brief space of two hours, whereas by Mr. Ransome's original process, only small blocks could be made, after a long period for drying and hardening in the kiln. The *Chronicle* quotes a report by Dr. E. Frankland, F. R. S., of St. Bartholomew's Hospital, who says the "patent concrete will be found equal to the best of Portland, Whitby Hare Hill, and Park Spring stones in its power of resisting atmospheric degradation, and if the newness of Ransom's stone (the specimen experimented upon not having been made a fortnight) be taken into cousideration, together with the well-known fact that its binding material, silicate of lime, becomes harder and more crystalline by age, I am induced to believe that Mr. Ransome has invented a material which, with the exception of the primary rocks, is better capable of giving permanency to external architectural decorations than any stone hitherto used." We are informed, moreover, that such is the confidence entertained in the imperishable properties of this material, it has been selected by Mr. Fowler, the engineer, for the facing of the Stations of the Metropolian Railway now in progress. We may also state that its capabilities of resisting strain and sustaining pressure have been found to be nearly three times that of Portland stone; thus, it may be fairly assumed that these qualities, combined with facility of production and the inexpensive nature of the materials used, must ensure for it general adoption in the construction, as well as in the embellishment, of buildings generally, and in works of art. Mr. Ransome has made enlargements and introduced fresh machinery at his works to carry on an extensive manufacture, but it should be observed that the process is so simple that the stone can be manufactured on the spot where the demand arises.

Thallium.

Mr. Crookes, whose discovery eighteen months ago of this new element by the spectroscope we have already announced, has since prepared numerous compounds of it, some samples of which are to be seen in the Chemical department of the International Exhibition. We were shown some time since a specimen in its pure metalic state, obtained by Mr. Crookes, but as no detailed statement of its characters, nor of the nature and actions of its salts, have been as yet published, although a short abstract has been displayed with the specimens since the opening of the Exhibition, it may be interesting to our readers to know what this new element—the only one discovered by an English chemist since Sir Humphrey Davy's detection of the metallic bases of the alkalies—is like. It is a dense heavy, rather lustreless metal, very like lead, to which metal it is also very similar in its physical properties, but is a trifle heavier, and tarnishes perhaps a little quicker. Its colour, however, is not identical. In chemical properties it is similar to mercury, lead, and bismuth. Mr. Crookes is continuing his researches, and we are glad to state that the Royal Society has voted him a grant of 50*l.* towards the expenses of these costly investigations.—*London Review.*

The Atlantic Telegraph.

The paddle-wheel steam surveying vessel *Porcupine*, 3, Master Commander Hoskyn, at Devonport, appointed on the application of the directors of the Atlantic Telegraph Company to take soundings in the Atlantic, will be provided with a donkey-engine on deck to assist the men. The machines which will be used are those called the "Bull-dog" machines. They are constructed on the principle best adapted for bringing up portions of the bottom. Brooke's apparatus will also be employed. The *Porcupine*, it is expected, will, in the first place proceed to that part of the Atlantic where there is what is popularly called a cliff in the bed of the Ocean, at which point it is supposed the former cable was broken. At the head of this declivity, about 200 miles from Ireland, there is a depth of 550 fathoms, and at the foot 1,750 fathoms, showing a difference of 1,200 fathoms. But this decline extends over a distance of eight miles, so that the fall is only one in eight. Other portions will, no doubt, be sounded. It is stated that in the event of a second attempt to establish telegraphic communication across the Atlantic, some place on the coast of Ireland, further north than Valentia harbour, will be selected for the purpose of obtaining a more convenient bed for the reception of the wire.

Effect of Small Elevations on the Mean Temperature of the Air.

M. Becquerel shows that there exists a vast difference between the temperature of the atmosphere close to the ground, and that measured at an altitude of 60 to 70 feet above it. The soil, its nature, colour, and the objects which cover it, all influence the temperature within the above limits. It had long been observed that vegetation varies according to height, and that certain plants which cannot be cultivated in the valleys, will thrive very well on the tops of the adjoining hills. Often, also frost will injure the flower of the vine, and respect that of the almond tree close by, which grows at a higher altitude. The director of the Botanical Gardens at Montpelier, has observed that laurel, fig, and olive trees die away in the lower parts of his garden, but are spared a few metres higher up, though in both cases protected by the same contrivances. M. Becquerel states that the mean temperature of the air at the "Jardin des Plants," during the year 1861, increased regularly from one metre to 33 metres above the soil, and this circumstance has prompted him to endeavour to fix the altitude of which the temperature represents the real average at a given spot. He has remarked the curious fact that at 6 a.m., all the year round, the temperature is the same at any altitude not exceeding 21 metres; 6 o'clock a.m. is, therefore, a critical period of the day, the temperature of which must stand in a certain relation to that of the month or year, and this relation he expresses by certain co-efficients, which vary according to the different seasons, and reach their maximum in summer, and

their minimum in winter. These co-efficients and the mean temperature at 6 a.m , will determine the temperature of the air at a given hour and altitude.

Jottings from the International Exhibition.

Had it not been for the watchfulness of the officials, the International Exhibition would have lately stood a good chance of being burnt down on very philosophical principles. In the Japanese Court, Messrs. Baring Brothers exhibit two extraordinary quartz spheres, four or five inches in diameter, ground and polished with mathematical nicety. These spheres stood side by side on a mahogany stand in the Japanese Court, attracting but little attention from the public, until one very sunny day a visitor suddenly rushed to the office of the department with the alarming intelligence that "the two glass globes had caught fire!" The officials, on going to the spot found the stand in a blaze, the sun having shone directly through the globes, which, of course, acted as burning-glasses, setting the woodwork on fire. There are now two holes in the mahogany stand large enough to insert the top of the finger. These holes are very interesting, as they are each double, showing perfectly the double refracting properties of the quartz. The spheres have been removed into the Chinese Court, that part of the building being quite in the shade.—*Chemical News.*

A Black Varnish for Zinc.

M. Bœttger describes a process for covering zinc with a chemical, adherent velvet-black varnish. Dissolve 2 parts by weight of nitrate of copper, and 3 parts of crystallized chloride in 64 parts of distilled water; add 8 parts of hydrochloric acid of 1.10 density; into this liquid plunge the zinc, previously scoured with fine sand; then wash the metal with water and dry it rapidly.

This coating constitutes a kind of metallic alloy. It is M. Bœttger's opinion, that characters in relief may be executed on a sheet of zinc by using this composition, and by employing dilute nitric acid (1 to 10), as the black coating resists the acid which attacks only the unpreserved metal.—*Scien. Amer.*

Ozone.

In a letter to Professor Faraday, Schönbein writes:—"After many fruitless attempts at isolating ozone from an ozonide, I have at last succeeded in performing that exploit; and have also found out simple tests for distinguishing with the greatest ease ozone from its antipode, 'antozone.' As to the production of ozone by purely chemical means, the whole secret consists in dissolving pure manganate of potash in pure oil of vitriol, and introcing into the green solution pure peroxide of barium, when ozone, mixed with common oxygen, will make its appearance, as you may easily perceive by your nose and other tests. By means of the ozone so prepared, I have rapidly oxidized silver at the temperature of 20°C., and by inhaling it produced a capital 'catarrh.'"

A New Telegraphic Instrument.

A new instrument, remarkable for rapid transmission of messages through long currents, has been exhibited at the Royal Society. It can transmit messages wlth the utmost ease and fidelity through 2,000 miles of continuous wire.

Best Grain at the World's Fair.

At a late meeting of the Bath and West of Eng-Ag. Society, Lord Portman, one of the jury on Agricultural Products at the London International Exhibition, stated that the best oats were from Nova Scotia: the finest samples of wheat from Australia, weighing 68 lbs. 7 oz. per bushel; The best flour also came from Australia. He attributed the excellence of Australian wheat to the climate of that country. The grain from the Zollverein States of Germany, with that also from Hungary, in the Austrian department, was represented as remarkably good.

Australian Gold Statistics.

A blue-book for 1861 published in Victoria states that the number of European alluvial miners in the colonies is 61,516; of Chinese, 24,536; quartz miners, 14,303 Europeans, and only 9 Chinese. The number of persons, miners and and those dependant on them, residing in the gold fields is 233,501; the valuo of machinery employed in alluvial and quartz mining, 1,411,012*l.* The prices of quartz crushing vary from 7s. to 1*l.* 10s. per ton, and prices of gold vary from 3*l*, to 3*l.* 19s. per ounce. The quantity of gold received by escort in 1861 was 1,832,887½ ozs., and the total quantity exported in same year was 1,967,420 ozs.

The Mount Cenis Tunnel.

Recent accounts of the gigantic tunnel through Mont Cénis state that the works are progressing favourably. It is ascertained that the tunnel will exceed eight English miles in length, and will pass under the ridge of the mountain at a depth of a full English mile below the surface. Shafts being out the question, the tunnel will be ventilated by compressed air, driven into it by machinery worked by water-power, which it is calculated, will drive about 51,000 cubic feet of compressed air into the tunnel daily. According to the present rate of working the tunnel will not be finished under six years; but we believe it is intended to increase the power of the boring machines, and to make them work more expeditiously.

Paris Permanent Universal Exhibition.

The project of the Paris Permanent Universal Exhibition has received the approbation of Napoleon III. and the ministers of Finance. Applications for space must be made on or before the 20th July next, to Messrs. J. Studdy, Leigh, & Co., of Leadenhall street, who are the appointed agents for Great Britain. The rental for goods or products of the first class, which will comprise all products and manufactures, whether open or in glass cases, will be 50 francs or £2 per annum per square metre; and for the second class, to which wall surface will be devoted, will be 25 francs or £1 per annum per square metre of wall space. Five square metres are equal to six square yards English.

Belgian Iron Paint.

The Belgium "minium," or iron paint, made at Anderghem, is a pure iron oxide mixed with about 1-4th its weight of silicious clay. It is said to contain no acid, and is now extensively used in this and other countries for painting ships' iron-work, gasholders, &c.—*Ironmonger.*

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

SEPTEMBER, 1862.

ON THE CULTIVATION OF WHEAT IN CANADA, AND ON THE SEASON OF 1862.

In the July and August numbers of this Journal we noticed the "Home Manufactures of Canada," and the "Use we make of our Mineral Resources," we now propose to devote a few pages to the Industry of the Soil, and the Manufactures which are dependent upon a constant and cheap supply of grain. In collecting material for this subject, the extraordinary fluctuations in the production of wheat in Lower Canada came so prominently into view, when contrasted with the rapid and steady increase in Upper Canada, that we were led to devote more space to this important subject than would appear to belong to the pages of this Journal, and our notice of "the Cultivation of Wheat in Canada and of the season of 1862," has swelled to a far greater extent than was anticipated, when a mere introduction to the condition of different manufactures in the Province, dependent upon a supply of rye, barley, wheat, and Indian corn was in contemplation.

There are many important questions which require solution, with respect to the cultivation of Wheat in Canada.

Two facts are patent to all from the results of the last census. These are:—

First; The cultivation of wheat is rapidly diminishing in Lower Canada, and the quantity raised does not amount to one half what is required to feed her population, assuming that each man, woman and child consumes five bushels only per annum.

Second; The cultivation of spring wheat is rapidly increasing in Upper Canada, and more than twice the quantity of land is devoted to spring wheat than to fall wheat.

With regard to the first statement—namely, the diminution in the cultivation of wheat in Lower Canada—we find that section of the Province formerly exported a very considerable quantity of wheat, the produce of her own soil. The following tables show the exports of wheat from Quebec between 1793 and 1802, inclusive:

Year.	Wheat, bus.	Flour.	Biscuit, cwt.
1793	478,900	10,900	9,800
1794	414,000	13,700	15,000
1795	395,000	18,000	20,000
1796*	3,106	4,300	3,800
1797	31,000	14,000	8,000
1798	92,000	9,500	12,000
1799	129,000	14,400	21,500
1800	217,000	20,000	25,000
1801	473,000	38,000	32,300
1802	1,010,033	28,300	22,051

In 1802 the population of Upper Canada did not exceed 60,000 souls, and there is no reason to suppose that that part of the Province contributed much wheat for export previous to 1802. The frontier States of the Union did, no doubt, contribute flour and wheat "in casks." We will therefore strike out from the above table all the exports of flour and biscuit, and credit them to the frontier States and Upper Canada, amounting to 855,500 bushels wheat, and 169,451 cwt. biscuit, from 1793 to 1802, a period of ten years.

With these deductions, the total quantity of wheat of Lower Canada growth exported between 1793 and 1802, amounted to 3,251,139 bushels, or at the rate of three hundred and twenty-five thousand bushels per annum.

The quantity of wheat raised in Lower Canada in 1827, '31, '44, '51 and '60 was as follows, showing no increase, but, in proportion to the population, an extraordinary and indeed alarming decrease:

Year.	No. of bushels.
1827	2,931,240 (1)
1831	3,404,756
1844	942,835
1851	3,045,600 (2)
1860	2,563,114 (3)

The quantity required to feed the population of Lower Canada, at five bushels per head, the usual allowance, is 5,553,320 bushels. Hence the people of Lower Canada, if they consumed wheat after the manner of their forefathers, would require an importation of not less than 2,990,206, or nearly three million bushels.

Nor is this decrease compensated by the production of other kinds of grain in due proportion. The total amount of barley, rye, peas, oats, buckwheat and Indian corn, raised in 1851, amounted to 12,147,000 bushels, and in 1860 to 23,534,903 bushels; † an increase of 11,387,633 bushels—not in fact even doubling in ten years, while during the same time the population increased from 890,261 to 1,110,664 souls.

* The exportation of wheat was prohibited this year, in consequence of the bad crops of 1795.

(1) Bouchette. (2) Census 1851-'2. (3) Mr. Galt's Budget Speech.

† Mr. Galt's Speech.

The comparison between Upper and Lower Canada stands thus in relation to population and the production of the following articles:

	Upper Canada.	Lower Canada.
Population, 1851	952,004	890,261
" 1861	1,396,091	1,110,664
Wheat crop of 1860, bus.,	24,620,425	2,563,114
Indian corn, rye, oats, barley, buckwheat and peas........................	36,122,340	23,534,903
Total bus. grain in 1860....	60,742,765	26,098,017

Proportion of grain produced in Upper Canada to each inhabitant, 43 bushels.

Proportion of grain produced in Lower Canada to each inhabitant, 23 bushels.

The change is astonishing which has taken place in Lower Canadian husbandry during the last half-century, and is certainly worthy of special study, and even of the attention of the Government. When a province which once was a large exporter of wheat becomes incapable, under her present system of husbandry, of raising one-half the quantity of a staple product of human food necessary for home consumption, questions of much moment arise. Does it result from a change in climate, from insects destructive to wheat crops, exhaustion of the soil, or bad farming practice? No doubt, more or less, from all of these causes united; but we must chiefly look to the manner in which the soil is cultivated, and the practice prevailing in Lower Canada, for the solution of this problem.

Turning now to Upper Canada, we find the following encouraging statistics:

Year.	Wheat produced, in bushels.
1842..............................	3,221,991
1848..............................	7,558,773
1851..............................	12,674,503
1860..............................	24,620,425

In some counties in Upper Canada the cultivation of wheat is progressing with extraordinary rapidity (too rapidly, we fear, for good husbandry), as the following comparative table, showing the produce of the United Counties of York, Ontario and Peel for the years 1848, 1850, 1851 and 1860, will tend to show:

Produce.	1848.	1850.	1851.	1860.
Wheat...	1,451,384	2,038,677	2,362,932	3,469,002

The United Counties, of York, Ontario and Peel produced in 1860, as much wheat as Lower Canada in 1831, and nearly one million more bushels than Lower Canada in 1860.

We would remind those among our readers who are inclined to the view that the Wheat Midge and the Hessian fly are preëminently destructive in Lower Canada, that by the use of early-ripening seed, draining, and improvement in farming practice, the "fly" has been overcome in many parts of Upper Canada, and there is no fear that with the adoption of well known artifices the ravages of these destructive insects will be held in check. And why, we ask, might not the same artifices have been employed in Lower Canada, which have proved so successful with us? Probably an answer will suggest itself when we compare the number and circulation of the newspapers published in the French language, with the number and circulation of the same means of diffusing information in the English tongue in Upper Canada. It is a question, we submit, which might reasonably engage the attention of the Minister of Agriculture, whether an enquiry should not be set on foot to obtain information respecting the cultivation of wheat in Lower Canada, and the best means of circulating a knowledge of the most successful remedies against the ravages of the Midge and Hessian fly, which are so generally instanced, and, we think, most erroneously, as the ineffacable destroyers of the wheat crops in Lower Canada, whose wide-spread devastations it would be vain to attempt to arrest.

The present year has been remarkable for the infinite number of insect-pests which have infested the wheat crops, but fortunately without, as far as we can learn, occasioning any wide-spread damage.

The insect which created the greatest alarm at one time was an Aphis, a very common and most prolific creature, whose powers of multiplying itself almost surpass belief, and furnish us with one of the most astonishing marvels of insect life, out of the vast number by which we are daily surrounded. If the reader has noticed the extremities of the shoots of currant bushes during the latter part of August and the beginning of September of the present year he will have observed, no doubt, a a vast number of green and brown insects feeding on the leaves, causing them to curl up, and often assume a dark or a bright colour according to the stage of insect growth. The green and brown insects are Aphids, similar to those which were found in such infinite numbers upon the succulent parts of the wheat and many other plants where they are not commonly observed during the early part of the summer.

The Aphis, or Plant Louse, is a name given to a very extensive genus of insects, whose destructive habits and wonderful productiveness make the study of their history especially interesting to farmers and gardeners. Certain species of Aphids affect different plants. Dr. Fitch describes twenty-eight species, which feed upon the juices of Indian corn, the pear, apple, cherry, and a number of

other trees. In the collection of the British Museum no less than 326 species of this insect are described, and it is worthy of notice that almost every species of plant has its own peculiar Aphis. The Hop-fly and Bean-dolphin have occasioned immense destruction in Britain. In 1802 the hop duty fell from £100,000 to £14,000 on account of the great increase of the Aphis. When the Aphis has been absent the duty has risen to £500,000. This insect is well named the APHIS OR EXHAUSTER. They are so prolific that one individual may become the projenitor of one qunitillion in the 10th generation. As many of our readers may not be quite familiar with the vast number represented by the word 'quintillion,' some details may be useful. Professor Owen shows in his lectures on 'Comparative Anatomy,' that the *Aphis lanigera* produces each year ten viviparous broods, and one which is oviparous, and each generation averages 100 individuals:—

1st Generation	....	1 Aphis produces
2nd "	....	100. One hundred
3rd "	....	10,000. Ten thousand
4th "	....	1,000,000. One million.
5th "	....	100,000,000. One hundred millions
* * *	* * *	* *
10th "	....	1,000,000,000,000,000,000 one quintillion.

The Aphids which appear in Spring are exclusively females, no males being found till the Autumn. It is not necessary for the young females produced during the Summer to pair with a male; yet these females go on producing each 25 a day of living young ones, all of which become in a short time as fertile as their parent.

It does not come within the province of this Journal to describe more in detail the habits of these insects, but to those of our readers who are interested in this curious subject we may refer them to the following accessible works, in which they will find much valuable information:—

1. First and Second Report on the Noxious, Beneficial, and other Insects of the State of New York. By Asa Fitch, M.D.
2. Harris on Insects. New Edition.
3. The Farmers' Encyclopedia. By Cuthbert Johnson.
4. The English Cyclopedia.
5. Stephens' Farmers' Guide.

The question naturally arises, why were these insects so numerous during the present year? The cause is to be traced, very probably, to the extraordinary dryness of the spring months of 1862.

The Aphis multiplies much faster in a dry season than in one which is humid; like the red spider, and many other destructive insects, it is fond of a warm and dry atmosphere. The month of May was extremely dry, and the quantity of rain recorded at the Toronto Observatory was only one third of the average which has fallen in that month for twenty-two years.

The month of June was also remarkably dry, the amount of rain which fell reaching only one third of the average of twenty-two years, and it was the dryest June which has occurred during the entire period in which observations have been made at Toronto. Fortunately for the wheat and other crops July was extremely wet, having nearly double the average fall of rain, so that not only were the crops pushed forward by the unusual moisture of this month, but an innumerable host of insects were washed off the leaves of the growing crops by the heavy and continuous fall of rain. By the most unusual and providential fall of rain in that month the multiplication of the Aphis was arrested and the crops of the country saved. It will be noticed throughout Canada, that in general the fall wheat has been harvested at an average time of the year—the spring crops are later than is common with us. The fall wheat was sustained during the long drought by the great amount of moisture in the soil at the advent of spring, from the excess of snow and rain which fell in February and March. In March we had one inch more rain and nearly ten inches more snow than the average of twenty-two years.

The retardation in the growth of the spring crops arising from the dryness of May and June has probably been of immense value to the country in destroying the Midge. That this insect was very abundant in many parts of Canada during the present year there is no reason to doubt; observations made in many different quarters have recorded its presence in infinite numbers, but the fly appeared before the wheat *was ready to receive it*, and its eggs were deposited where there was not suitable food for the young worms when hatched; myriads would consequently die for want of food, and therefore we may look upon the unusually dry spring of 1862 as having been a blessing of incalculable value to the Canadian Farmer by destroying one of the worst and most widely distributed enemies of his wheat crops. The maggots of the Midge were also seen in vast numbers in the fall wheat, but generally it was too far advanced for them to injure it to any considerable extent. The fall wheat was suddenly pushed forward by the July rains (which at the same destroyed the Aphis) and the Midge could not penetrate the chaff or sheath to deposit its eggs, or if it succeeded in penetrating the germ the young worms were hatched after the grain had been formed. Although this year has been one of most exceptional character in relation to the distribution of snow and rain, yet when viewed in the proper light it will afford a striking illustration of that

wise and merciful benificence which disposes and adjusts all things for some excellent purposes, which do not appear to our eyes until the object for which the disposition was made is attained, and sometimes not even then.

The following table from the records of the Provincial Observatory has been kindly furnished by Professor Kingston—an examination of its contents will show the extraordinary character of May, June and July of the present year.

	May,	June.	July.
Mean Temp'rature 1862.......	52.17	60.52	66.70
Average for 22 years........	51.39	61.36	66.85
Difference from average......	+0.78	—0.84	—0.15
	Inches.	Inches.	Inches.
Depth of Rain, 1862.	1.427	1.007	5.344
Average of 22 years...........	3 241	3.100	3.490
Difference form average......	—1.814	—2.093	+1.854
	Days.	Days.	Days.
No. of Rainy days, 1862.....	8.0	10.0	15.0
Average of 22 years.	11.3	11.9	10 0
Difference from average......	—3 3	—1.9	+5.0

May, 1862, was mild, and extremely dry, but it was thrice surpassed in that respect: it only records one-third of the average depth of rain.

Jnne, 1862, was comparatively cold and extremely dry, the depth of rain recorded only reached one-third of the average; it was absolutely the driest June during the last 23 years.

July, 1862, was comparatively cold and extremely wet, shewing nearly double the average depth of rain, it was only once surpassed, viz. in 1841 when the depth received amounted to 8.150 inches.

A comparison of the foregoing with the corresponding months of the several years may be made by referring to the comparative tables that accompany the monthly reports for May, June, and July, 1861, pnblished in the *Canadian Journal.*

A glance at the following table will show how dependent the prosperity of the country is upon a good harvest. It will be seen that the difference between the agricultural exports of 1856 and 1857 amounted to more than six millions of dollars, and that our exports last year exceeded those of 1857 by ten millions of dollars.

Table of the absolute value of all Agricultural products exported, exclusively of Canadian growth, for the years 1863 *to* 1861, *inclusive.*

Year.	Value of Ag. Exports.	Year.	Value of Ag. Exports.
1853	$8,032,535	1858	7,904,400
1854	7,316,160	1859	7,339,798
1855	13,130,399	1860	14,259,225
1856	14,972,276	1861	18,244,631
1857	8,882,825		

In our next issue we shall endeavour to exhibit the use we make of a considerable portion of our rapidly increasing grain crops, and show how closely dependant many important manufactures in Canada are upon a good harvest.

FACTS FROM THE CENSUS FOR UPPER CANADA.

The quantity of butter made in 1861 amounted to 26,828,264 lbs., and of cheese to 2,687,172 lbs.

In 1851 there were 16,064,532 lbs. of butter, and 2,292,600 lbs. of cheese made, or

1861...	26,828,264	lbs. butter.
1851................	16,064,532	"
Increase in 1861...	10,763,732	lbs. butter.
1861................	2,688,172	lbs. cheese.
1851................	2,292,600	"
Incr. in 1861.......	394,572	lbs. cheese.

Beef in barrels:

1851	113,445	
1861	67,508	
Decrease in 1861......	45,937	bbls. beef.

Pork in barrels:

1861	336,744	
1851	317,010	
Increase in 1861......	19,734	bbls. pork.

The increase in barrelled beef and pork, and consequently in the export of these articles, is very small in ten years, and shows that in this branch of the provision trade Upper Canada has not made much progress by comparison with the years 1851 and 1861.

The exports from the Province of beef, pork, butter, and cheese, for the years 1859, 1860, and 1861, were as follows:

	1859.	1860.	1861.
Beef...	3,235 cwt.	1,846 cwt.	1,598 cwt.
Pork..	36,984 "	63,109 "	81,032 "
Butter	3,750,296 lbs.	5,512,500 lbs.	7,275,426 lbs.
Cheese	323 cwt.	1,100 cwt.	2,628 cwt.

The Fisheries of the Upper Province do not show that increase which might be expected from the valuable resources of the great Lakes.

In 1851 there were 11,886 barrels of fish cured; in 1861, 10,013 barrels; 2517 quintals, and 175,744 lbs. of fresh fish sold.

In Michigan, which is the largest inland fish producing state, the value of white fish returned in 1860, amounted to $250,467. There is yet a vast field open for remunerative enterprise in the fisheries of Lakes Huron and Superior. The whole of the north shore of Lake Huron with its million islands will yet yield great wealth to the country from its clear and cold waters. The art of the preservation of fish is as yet unknown in Canada, or rather it is not practised. In Germany, France, and Britain, Pisciculture is now an acknowledged department of national importance. It would be

a wise economy on the part of the Government to examine into the working of fishing regulations and Pisciculture now in operation in Europe. A few skilled emigrants from France, Germany, or Britain, would soon enable Canadians to rejoice in the possession of the finest fresh-water fisheries in the world.

NECESSITY FOR A GOVERNMENT PETROLEUM INSPECTOR.

Two thousand barrels of Canadian oil were lately ordered by a German house, and dispatched from Enniskillen to Montreal to be shipped for Bremen. When the oil was examined accidentally at Montreal it was found to be *adulterated with water*. On enquiry at Enniskillen it was ascertained that the party furnishing the oil had pumped it from Black Creek, and sent only surface oil mixed with water. Fortunately this was found out in time, or else this miserable specimen of Canadian oil would have been shipped to Germany, and a bad name given at the outset to a most important and rising branch of Canadian trade. Many enquiries are now being made for Canadian Petroleum, and there is every prospect of a large trade with Continental Europe springing up. But if we wish to retain the trade it is essentially necessary that the dealings of oil-shippers should be honest and upright or else the trade will rapidly acquire a bad name. In order to prevent such wretched frauds as we understand have recently been attempted, all exported oil should be subjected, we submit, to the inspection of an officer appointed by the Government, and each barrel branded according to its character, its specific gravity being determined, as well as freedom from admixture with water. The system adopted for branding fish barrels, &c., would be of vast advantage to the oil-dealer as well as to the country.

The extraordinary importance of the Petroleum trade may be inferred from the fact, that the exports of Petroleum, crude and refined, from the United States for the first half year of 1862, amounted to 4,379,669 gallons, equal to 109,492 barrels, valued $1,413,390.

It is now sent to every quarter of the globe. At Philadelphia the price has varied from 23 cents on January 4th, to 9 cents a gallons for crude oil on May 10th. It is now, August 10th, 12 to 14 cents a gallon for crude, and 25 to 32 for refined. The largest exportations have been sent to Liverpool, the quantity in the first half year of 1862 being 2,291,344 gallons, this is exclusive of Enniskillen oil. Liverpool takes nearly as much as all the rest of the world together, Enniskillen oil men should note this, and keep a sharp look-out on any one who attempts by dishonest dealing to make a few dollars for himself at the risk of ruining a most valuable trade.

WHY DO WE NOT CULTIVATE GINSENG?

The value of this plant as an article of trade is now very little known in Canada. Among the Chinese the Ginseng (*Panax quinquefolium*) is all important as a constituent of their most expensive medicines.

It grows wild in Canada and the Northern parts of the United States. From 1803 to 1807 the annual value of the Ginseng exported was $123,000, from 1823 to 1830, $157,000. In 1841, 640,967 lbs. valued at $437,265 was exported from the United States.

The Ginseng was discovered in Canada by the Jesuit Lafitu in 1716. A pound weight of this root, once worth two francs at Quebec, sold for 25 francs in Canton; its price subsequently rose to 80 francs the pound. One year the Canadian export of Ginseng, during the occupation of the country by the French, exceeded one hundred thousand dollars. The root resembles a small carrot about three or four inches in length.

The price of Ginseng in the Chinese seaports varies from 75 to 130 dollars for 133 lbs. for the crude, and from 130 to 200 dollars for the cured, or at the rate of six shillings sterling a pound. In Canada this plant grows wild in abundance, and the sample is of the best quality. Two hundred thousand pounds weight of Ginseng were exported from St. Paul last year. In former times the exportation from Canada was very great, but the trade declined in consequence of a "bad name" having been given to Canadian Ginseng on account of the practice of gathering the plant at a wrong season of the year, when it was considered by the Chinese, who are its chief consumers, wholly unfit for medicinal preparations. The collection of the Ginseng root, if not its cultivation, is well worthy of attention in Canada.

In the preceding article we have referred to the gross fraud which has been attempted at Enniskillen—to send waste petroleum, pumped from the surface of Black Creek, to a German house. A century ago, Canada had a rich trade in Ginseng, which she subsequently lost, through the cupidity of the dealers at that period knowingly collecting ginseng at all times of the year, and exporting it as the prime article. They lost the trade by this fraudulent proceeding, and have left their posterity an example which it is to be earnestly hoped the Canadian Oil Association will know how to improve, and take steps to prevent its occurrence in our time.

INTERNATIONAL EXHIBITION.

AWARD OF MEDALS, &c., TO BRITISH AMERICANS.

Medalists.

The Comissioners for Canada, for the display of woollen goods and hand-yarns manufactured in the colony.

The Government of Prince Edward's Island, for a very interesting and varied collection of woollens, mixed fabrics, &c., homespun and made, illustrative of the domestic industry of the colony.

Government of Newfoundland, for a very fine collection of skins of silver cross, and red fox, and otter.

W. Coleman, Nova Scotia, for a very choice collection of skins, fine specimens of silver, red, and cross-fox, otter and mink.

McEwen and Ried, Nova Scotia—sofas, chair, and cabinet of native wood—for excellence of workmanship.

— Snell, of Canada, for good machine-made nails.

— Scrymgeour, New Brunswick, for well-made horse-shoes.

Captain R. Gaskin, Kingston, Canada, for a collection of agricultural hand instruments.

Tongue & Co., Canada, for an assortment of edge tools highly finished.

Hon. P. J. O. Chauveau, for the merit of his collection of educational journals and reports.

The New Brunswick Committee for the Exhibition, for their collections of woods illustrating the study of botany.

—Downes, of Nova Scotia, for his collection of animals.

Professor Howe, Nova Scotia, for the excellence of his mineralogical collection.

J. M. Jones, Nova Scotia, for his collection of fish.

J. Mosher, Nova Scotia, for good manufacture of blocks on the Bothway principle.

W. Notman, Montreal, for excellence in an extensive series of photographs.

Captain P. Gaskin, Kingston, Canada, for a collection of agricultural tools.

J. Jeffrey, Canada, for iron plough.

J. McSherry, Canada, for iron plough.

J. Morley, Canada, for iron plough.

J. Patterson, Canada, for iron plough.

Whiting & Co., Canada, for collection of agricultural tools.

New Brunswick Commissioners, for a horse-rake.

J. Brown, Canada, for the excellence of manufacture of hydraulic cement.

G. R. Stephenson, as the representative of his cousin, the late R. Stephenson, M. P., F. R. S., for the extraordinary boldness of conception and the great ingenuity of the construction of the Victoria Bridge, Canada.

Larue & Co., Canada, cast iron hollow wheels, for excellence of workmanship and proved durability.

The Executive Committee of Vancouver's Island, for spar of Douglas pine, 220 feet.

Edward Stamp, Vancouver's Island, for a section of Pinus Douglassii, six feet diameter, with roof shingles and other timber specimens.

Blaikie & Alexander, Toronto, for dressed flax.

Andrew Bridge, Canada, for a tub on a new principle of construction, exhibiting much taste and ingenuity.

E. B. Eddy, Ottawa, for machine-made wooden pails and tubs, at exceedingly low prices.

C. L. Ingersoll, Canada, for a cask constructed on a new and ingenious principle, for five liquids.

James Lawrie, Canada, for planks and logs, and 21 named specimens of logs from the Ontario district.

Hugh McKee, Canada, for scientifically-named collection of 98 of the woods of the colony, accompanied with leaves, &c.

T. Moore, Canada, for a large collection of excellent handles for tools and implements in hickory and other woods.

Nelson & Wood, Canada, for whisks and brooms of Sorghum straw, at very low prices, from 1s. 6d. to 6s. per dozen.

Duncan, Porter & Co., Canada, for 19 very fine square logs of timber.

The Abbè Provancher, Canada, for a very extensive, accurately named and extremely well illustrated collection of the woods of the colony, accompanied with dried specimens, useful information, &c.

Samuel Sharp, G. W. R. R., Hamilton, for a magnificent collection of planks, polished slabs, veneers, and a named collection of 26 specimens, from Western districts.

James Skead, Canada, for a magnificent collection of planks, logs, and a scientifically named collection of 27 woods, all from the Ottawa districts.

D. R. VanAllen, Canada, for planks and logs, all magnificent specimens from the Thames district, and 21 scientifically named specimens.

A. L. Trimbinski, Canada, for magnificent logs of white oak, rock elm, and hickory,

Miss E. Begg, Nova Scotia, for application of native grass to plaiting and bonnet-making.

Miss E. Begg, Nova Scotia, for very fine samples of flax prepared by dew rotting.

Miss Hodges, Nova Scotia, for baskets decorated with pine cones and other hard fruits.

Miss Lawson, Nova Scotia, for a collection of forest leaves of the colony, so prepared as to preserve the autumn tint.

— Pryor, Nova Scotia, for a preparation of the fibre of *Melilotus leucantha major.*

Local Committee of Prince Edward's Island—for a collection of wicker work, &c., including excellent flax, well dressed.

Miss E. Jardine, New Brunswick—for ornamental work of native seeds.

D. Munroe, New Brunswick—for an excellent scientifically named collection of 21 woods, veneers, &c., accompanied with specimens, and a volume of valuable notes and observations.

E. Potter, New Brunswick—for fine carving in a wooden box.

Mrs. D. B. Stevens, New Brunswick—for ornamental work in native seeds.

Campbell and McLean, Nova Scotia, cavendish tobacco. Quality of Tobacco used, and quality of article produced.

— Barber, Nova Scotia—salmon and lobster; excellence of quality.

J. Cairns, Prince Edward's Island—salmon and lobster; excellence of quality.

D. Brown, Canada—maple sugar; excellence of quality.

New Brunswick commissioners—spiced salmon; excellence of quality.

S. Knight, Newfoundland—preserved salmon and lobster; excellence of quality.

W. Boa, Canada—for all his samples of substances used for food.

R. L. Denison, Toronto—Indian corn stalks; for extraordinary growth.

W. Evans, Canada—for collections of grains and seeds, excellent and interesting.

J. Fleming, Toronto—for seeds and grains, as excellent and interesting.

B. Johnstone, Canada—for samples of Soule's winter wheat, of excellent quality.

J. Logan, Canada—for spring wheat of excellent quality.

County of Peel Agricultural Society, U. C.—(medal to John Lynch, Sec.) for barley, peas, and two kinds of spring wheat, all of excellent quality.

A. Shaw, Canada—for rye of excellent quality.

County of Beauharnois Ag'l Soc'y L.C., (two medals awarded to growers), for flax seed, grown by C. Burguin, for grass seed grown by C. Tait.

J. Wilson, Canada—for oatmeal of excellent quality.

The New Brunswick Commissioners, for the excellence of their collection of substances used for food.

The Commissioners of Newfoundland, for a fine collection of seeds.

R. G. Fraser, of Nova Scotia, for excellent grain, of garden and field seeds.

Local Committee of Prince Edward's Island—for interesting collection of agricultural produce.

Agricultural Board of Upper Canada—for samples of wheat from various counties of excellent quality.

Agricultural Society of Huntingdon, L. C., (one medal to grower), for peas 40 bushels per acre grown by John Penis.

Agricultural Society of Wellington, U.C., for wheat of excellent quality.

Agricultural Society of Wentworth and Hamilton, U. C., (three medals to growers), for blue stem wheat grown by I. H. Anderson, for red chaff wheat grown by John Smith, for potato oats grown by A. Gorie, very superior in quality.

Spurr D. Wolfe, New Brunswick, for products obtained by the distillation of coal.

Executive Committee of Vancouver's Island, for collection of Agricultural seeds.

Benson and Aspden, Canada, samples of Indian corn starch. For the excellent quality of samples.

Canadian Oil Works, Hamilton, for an extensive exhibition of the derivatives of petroleum.

E. A. McNaughton, Canada, flour and potato starch. For the excellent quality of samples.

Parson Bros., Toronto, Canada, for an extensive exhibition of the derivatives of petroleum.

E. Billings, of the Geological Survey, Canada, for his published decades on Canadian fossils, and his valuable general contributions to palæontology.

English and Canadian Mining Co., for the skill and perseverence with which they have opened their ground, and the discovery of composits conformable with the stratification.

Foley & Co., Canada, for plans of mines, ores and lead, smelted in the colony.

J. Sterry Hunt, of the Geological Survey, Canada, for the instructively described series of the crystaline rocks of Canada, and his various published contributions to geological chemistry.

Larue & Co., Canada, for excellent cast iron railway wheels made from bog iron ore, which have run 150,000 miles.

Montreal Mining Co., for interesting series of copper ores, accompanied by sections of the workings.

A. Taylor, Canada, for good specimens of crude and prepared gypsum, with plans and sections of the gypsum mines.

The officers of the Geological Survey of Canada, for an admirably prepared selection of specimens, illustrating the mineral resources of the Province.

B Walton, Canada, for the discovery of good roofing slates.

West Canada Mining Co., for specimens and plans, illustrations of well-worked copper mine.

—Williams, (Enniskillen,) for introducing an important industry, by sinking artesian wells in the Devonian strata for petroleum.

New Brunswick Companies, for general collection of the works and minerals of the colony.

The Government of Newfoundland for a general collection of the rocks and minerals of the Island.

Rev. Mr. Honeyman, Nova Scotia, for a large collection of specimens illustrating the geology of the colony.

Prof. Howe, Nova Scotia, for collection arranged by him, illustrative of the rocks and minerals of the Province.

Government of Nova Scotia, for the large and instructive collection, illustrating the occurrence of gold.

J. Scott, Nova Scotia, for column of coal, showing the entire height of the seam, 34 feet; one of the thickest known beds in the world.

Honourably Mentioned.

The following is a list of those who are honourably mentioned:

E. L. Betts, Canada, J. Hodges, Canada, and Sir S. M. Peto, Bart., M. P., a collective honourable mention for the successful execution of the Victoria Bridge, and for the ingenuity displayed by Mr. Hodges in constructing the coffer dams for the same.

New Brunswick Commissioners, models of bridges. For the utility of the works represented by the models.

Prof. Howe, Nova Scotia, for goodness of quality of specimen building stones.

T. Scarfe, Nova Scotia, good quality of common and pressed brick, and drain tiles.

Palmer & Sheppard, Canada, for the excellence of his white bricks and drain tiles.

Missisquoi Drain Tile Company, Canada, for drain tiles of good quality.

F. Claudet for a series of views in New Westminster, British Columbia.

Bowren & Cox, New Brunswick, for photographic views, being the earliest taken in that colony.

W. H. Adams, of New Brunswick, for railway springs.

— Spiller, New Brunswick, for collection of edge tools.

G. Connell, Nova Scotia, for axes.

Mrs. W. Black, for her models of fruits.

Gordon & Keith, Nova Scotia, for the excellent workmanship of their furniture.

James Thomson, Canada, for his collection of birds.

E. O. Richards, Canada, for model of water wheel.

Fleming & Humbert, New Brunswick, for oscillating steam engine.

W. G. Simpson, Nova Scotia, for model of gold washer.

Government of Prince Edward's Island, for good specimens of tanned lambskin rugs.

L. D. Sovereign, Canada, for his combined cultivator and drill.

H. Collard, Canada, for his cultivator.

S. H. Gilbert, New Brunswick, for his model of stone picker.

S. Sharp, Canada, Great Western Railway, model of sleeping and freight cars.

A. Bronson, Canada, for magnificent sections of strobus and white oak.

— Burrows, Canada, for fine sections of "laurus sassafras."

Jacob Choate, Canada, for fine cherry wood and soft maple planks.

— Coutlee, Canada, for named collection of 72 woods of the colony.

O. Gingras, Canada, for fine planks of timber.

Miss Crooks, Canada, for collection of 490 native plants.

F. X. Prieux, Canada, for a named collection of 74 woods of the colony.

E. H. Rose, Canada, for a box of very fine walnut veneers.

— Truman, New Brunswick, for veneers of good quality, and a book formed of inlaid slabs, barks, &c., illustrating the woods of the colony.

N. Norman, Newfoundland, preserved wurcle, goodness of quality.

Nova Scotia Commissioners, salted salmon, goodness of quality.

Rev. F. L. D'Heureux, maple sugar, illustrative.

The Agricultural Society of Huntingdon, L. C., for barley, grown by Mr. McNaughton.

The Agricultural Society of Wentworth, U. C., for collection of wheat, goodness of quality.

T. Badham, Canada, for oats of good quality.

J. Logan, Canada, for barley, goodness of quality.

A. Shaw, Canada, for Indian corn and marrowfat peas, excellent quality.

C. Wilkins, Canada, Indian corn, goodness of quality.

Miss Bossoult, Nova Scotia, for water colour paintings of native flowers, as instructive.

Dr. Howe, Nova Scotia, medicinal and other plants.

W. H. A. Davis, Canada, for interesting and instructive specimens from a remarkable deposit.

H. T. McCaw, Canada, for fine instructive specimens of ores running with the stratification, and illustrating the structure of the country.

S. Sweet & Co., Canada, for fine and instructive specimens of ores, running with the stratification, and illustrating the structure of the country.

HOT WATER CIRCULATING APPARATUS FOR WARMING PURPOSES.

BY MR. PURNELL.*

FIG. 1

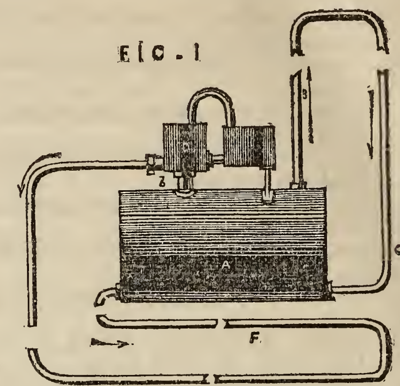

FIG. 2

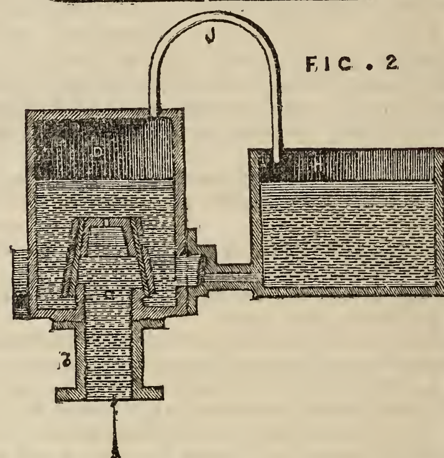

Fig. 1 is a diagram, and fig. 2 is an enlarged section of the principal part of the apparatus.

Ordinarily, hot water is made to circulate through pipes by placing the boiler A, fig. 1, at the lower end of a range of pipes, B and C. The water in the boiler, and in the pipe B, from the top of the boiler, becomes heated, and slightly lighter than that in the return pipe C, which communicates with the bottom of the boiler. The cooler and heavier water tends continually to displace the warmer and lighter, and a circulating current in the direction of the arrows is thereby induced and kept up. In this arrangement the pipes are entirely, or for the most part, above the level of the boiler; but if the pipes were for the most part below that level, the circulation would not (with ordinary arrangements) take place, as the warm lighter water in the descending branch could not force up the cold heavier water in the ascending return branch.

It is often extremely inconvenient to find a proper place for the boiler sufficiently below the general level of the pipes; and some simple means to cause circulation to take place in pipes on or below the level of the boiler has been a great desideratum.

In Mr. Purnell's arrangement, a pipe *b*, from the top of the boiler, A, communicates with a valve-box, D, from which there proceeds the descending or out-

* Paper read, and a working model shown in operation, at the Institution of Engineers in Scotland.

going branch, E, the ascending return branch, F, communicating with the bottom of the boiler. In the box, D, there is a pair of simple, freely-working clack-valves, G, which the water has to lift in passing from the boiler to the branch E. To keep up the supply of water, there is a cistern, H, communicating through a clack-valve with the box, D; and this cistern may itself be kept full by an ordinary float-cock on a service pipe. The box, D, is open to the atmosphere by the pipe, J, which is bent over to the cistern merely to catch any dripping from condensed steam.

The working model was contrived so that it could be arranged with either the old or the new arrangement, and it was shown that with the old arrangement no circulation took place in the pipes, whilst with the new plan a regular continous circulation was at once established, the pipes being below the level of the boiler in both cases.

After trying a great many different plans, the the present one was at length arrived at by Mr. Purnell; but it is not easy to explain how the action takes place. In the working model the box, D, was formed with glass sides, through which it could be seen that the valves did not remain steady, but were in a continual tremor. Indeed, without an intermittent action it is difficult to conceive how the result obtained could be produced. The opening of the valve indicated a temporary increase of internal pressure, which would give the water a tendency to leave the boiler by both branches, E and F. If the water were previously quiescent, the exit would actually be freer by the return branch, F, the valves obviously offering some slight resistance the other way. If the water were already in motion in the pipes, the tendency would take effect in slightly retarding the entrance of the water into the boiler by the return branch F. The next step of the action is the closing of the valves, which must be due to a diminution of the internal pressure, and the water must tend to return into the boiler, but being prevented from returning by the valves of the branch, *b*, must do so entirely by the branch F, and so the circulating current is gradually established. The intermittent variation in the internal pressure has yet to be explained; but it appears that, however regular the fire is, the intermittent or pulsating action exists. The model boiler was heated by a gas jet, the heat from which is perhaps as regular as can be obtained.

In reply to enquiries, Mr. Purnell further explained the details of his apparatus, and stated that he had it in operation on a large scale in different warehouses in Glasgow, and also in garden hothouses. A very convenient application of it was where it was wanted to heat a single flat of a building. Formerly the boiler had to be placed in the flat below, which might be occupied by a different tenant; but with his arrangement the boiler might be placed on the same flat with the pipes below it near the floor, and even beneath the floor, where required.

Board of Arts and Manufactures

FOR UPPER CANADA.

MEETING OF THE SUB-COMMITTEE.

At the Monthly Meeting of the Sub-committee of the Board, held on Thursday, the 4th instant, present: the President, (Dr. Beatty), the Vice-President, (Dr. Craigie), Professor Hincks, Professor Hind, and W. H. Sheppard, T. Sheldrick and R. Bull, Esquires, a Special Committee was appointed to draft a Memorial to the Government relating to the Statute for the encouragement of Agriculture and Manufactures; and to report such draft to the Sub-committee at its next meeting.

The Free Library of Reference, and Model Rooms, will be open to the public on the evenings of *Monday, Tuesday, Wednesday, Thursday and Friday*, of the Exhibition Week, in addition to the usual hours each day.

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE.

CLASS VII.

Cyclopœdia of Useful Arts and Manufactures, parts I to IX, 1862 .... *C. Tomlinson.*

CLASS X.

Discourses on Painting and the Fine Arts—delivered at the Royal Academy, 4to, 1856 .... *Sir J. Reynolds.*

CLASS XI.

Topographical and Statistical Description of Lower and Upper Canada, and the other British North American Provinces; 2 vols. 4to 1832 .... *Jos. Bouchette.*
Topographical Dictionary of Lower Canada, 4to., 1862 .... "

CLASS XIII.

A Treatise on some of the Insects injurious to Vegetation, 8vo., 1862 .... *T. W. Harris, M.D.*

CLASS XV.

Popular Lectures on Food, delivered at the South Kensington Museum by the Superintendent of the Animal Products and Food Collections, 12mo., 1861 .... *E. Lankaster, M. D.*
——— On the Uses of Animals in Relation to the Uses of Man, delivered at the South Kensington Museum, 12mo .... "
Book of Legal Forms and Law Manual, 12mo, 1854 .... *W. H. Richmond.*

CLASS XVIII.

Specifications of Inventions, Letterpress, 26 vols., 8vo., 1860 .... *British.*
" " Plates, 36 vols., folio, 1860 .... "

ALPHABETICAL LIST OF THE PRINCIPAL ENGLISH PUBLICATIONS FOR THE MONTH ENDING JULY 31.

Ancient Empires: their Origin, Succession, and results, 8vo	0	6	0	*Rel. Tract Soc.*
Annual Register (The) 1861. Vol. 103, 8vo	0	18	0	*Rivingtons.*
Annual Retrospect of Engineering and Archi. Vol. 1, 1861, ed. by G. R. Burnell, post 8vo	0	7	6	*Lockwood.*
Arrivabene (Count C.) Italy under Victor Emmanuel. A Personal Narrative, 2 vols. 8vo	1	10	0	*Hurst & Black.*
Austin (J. G.) On Preparation, &c., of Calcareous and Hydraulic Limes and Cements, 12mo	0	5	0	*Trübner.*
Cabinet Lawyer (The) a Popular Digest of the Laws of England, 19th edit., fcap. 8vo	0	10	6	*Longman.*
Chamber's Journal of Popular Literature. Vol. 17, sup. roy. 8vo	0	4	6	*Chambers.*
Coleridge (Herbert) Dictionary of the First or Oldest Words in the Eng. Lang. roy. 8vo	0	2	6	*Hotten.*
Du Breuil (M.) Sci. & Prac. of Grafting, Pruning & Training Fruit Trees, cr. 8vo	0	6	0	*Kent.*
Every Boy's Book; a Complete Enclyopœdia of Sports, new edit., sm. cr. 8vo	0	8	6	*Routledge.*
Fletcher (G.) Parliamentary Portraits of the Present Period, 3rd series, post 8vo	0	7	6	*Ridgway.*
Gamgee (John) Our Domestic Animals in Health and Disease, 2nd division, cr. 8vo	0	6	0	*Hamilton.*
Grant (James) Memorials of the Castle of Edinburgh, 2nd edit. fcap. 8vo	0	3	6	*Blackwoods.*
Gronow (Capt.) Reminiscences of, being Anec. of the Camp, Court, & Clubs, cr. 8vo	0	9	0	*Smith & Elder.*
Guizot (M.) Embassy to the Court of St. James in 1840, 2nd edit., 8vo	0	14	0	*Bentley.*
Irving (Washington) Life & Letters of, by his Nephew, P. E. Irving. Vol. 1, post 8vo	0	2	0	*Bohn.*
Jay (Wm.) Autobiography; edit. by G. Redford and J. A. James, cr. 8vo, red to	0	5	0	*Hamilton.*
Johns (Rev. C. A.) British Birds in their Haunts Illustrated, cr. 8vo	0	12	0	*Soc. Pr. Ch. Kn.*
Johnston (A. K.) Dictionary of Geography, Descriptive, Physical, &c., n. ed., rev. 8vo	1	10	0	*Longman.*
Keane (Wm.) Young Gardener's Educator, 8vo	0	5	6	*Groombridge.*
Kearley (Geo.) Links in the Chain; Chap. on the Curiosities of Animal Life, fp. 8vo	0	3	6	*Hogg.*
Laurie (W. F. B.) Northern Europe (Denmark, Sweden, Russia) in 1861, 8vo	0	12	0	*Saunders & O.*
Linton (Wm.) Colossal Vestiges of the Older Nations, post 8vo	0	6	0	*Longman.*
Lloyd (Julius) Life of Sir Phillip Sydney, sq. cr. 8vo	0	7	6	*Longman.*
Macdonald (Duncan G. F.) British Columbia and Vancouver's Island, 8vo	0	12	0	*Longman.*
M'Ghee (Rev. R. J. L.) How we got to Pekin, a Nar. of Chinese Campaign, 1860, 8vo	0	14	0	*Bentley.*
Mining and Smelting Magazine (The) Vol 1, Jan. to June, 1862, 8vo.	0	7	0	*Office.*
Moore (Thomas) Field Botanist's Companion, with Coloured Illustrations, 8vo	1	1	0	*L. Reeve.*
My Country; The History of the British Isles. By E. S. A. Part 5, 18mo	0	1	6	*Werlheim.*
Observational Astronomy, and Guide to the use of the Telescope. Edited by J. T. Slugg, p. 8vo	0	4	0	*Simpkin.*
Pratt (H. F. A.) On Eccentric and Centric Force, a new Theory of Projection, 8vo	0	10	0	*Churchill.*
Reid (Hugo) Hand-Book of the History of the United States, fcap. 8vo	0	2	6	*Griffith & Far.*
Rickmam (T.) Styles of Architect in Eng., 6th ed., with addns. by J. H. Parker, 8vo	1	1	0	*J. H. & J. Parker*
Ritchie (Robert) Treatise on Ventilation, Natural and Artificial, 8vo	0	8	6	*Lockwood.*
Ronalds (Alfred) Fly-Fisher's Entomology, with coloured illustr., 6th edit., 8vo	0	14	0	*Longman.*
Simmonds (P. L.) Waste Products and Undeveloped Substances, fcap. 8vo	0	6	0	*Harkwicke.*
Smee (Alfred) General Debility and Defective Nutrition, 2nd edit., fcap. 8vo	0	3	6	*Churchill.*
Templeton (W.) Engineer's Millwright's and Machinist's Prac. Assist., 2d ed., 18mo	0	2	6	*Lockwood.*
Tuckett, (P. D.) Prize Designs for Covered Homesteads for Farms of 200 and 500 Acres, 8vo	0	5	0	*Weale.*
Waterston (W.) Manual of Commerce, new edit., revised, fcap. 8vo	0	3	6	*Simpkin.*

AMERICAN PUBLICATIONS FOR AUGUST.

Bernhard (Wm.) Book of One Hundred Beverages for Family Use, 16mo	$0 25	*James Millar.*
Hittell (J. S.) Mining in the Pacific States of North America, 16mo	0 70	*John Wiley.*
Lewis (Dio, M.D.) The New Gymnastics for Men, Women, and Children, with three Hundred Illustrations, 12mo	1 00	*Ticknor & Fields.*
Rankin (W. H., M.D.) Half-Yearly Abstract of the Medical Science. Vol. 35, Jan. to June, 1862, 8vo	$1 00	*Lindsay & Blackiston*

Proceedings of Societies.

TORONTO MECHANICS INSTITUTE.

A quarterly meeting of the members of the Mechanics Institute was held last evening Aug. 11th in the Lecture Room, Mr. William Edwards, 1st Vice-President, occupying the chair.

The Secretary read the minutes of the annual meeting, after which it was moved, by Mr. D. Carnegie, in accordance with a notice previously given, that the subscription of members be increased from $2 to $2 50 per annum. The motion was seconded by Mr. W. S. Lee. After a spirited discussion, in which part was taken by Messrs. Carnegie, Lee, Halley, Withrow, Sheppard and others, the motion was carried.

It was moved by Mr. W. S. Lee. seconded by Mr. W. Halley, that in accordance with the recommendation of the Board of Directors in their annual report, that the subscription of life members be reduced from $40 to $20, and that the money derived from this source be invested in a sinking

fund for the liquidation or reduction of the debt of the building. The motion was unanimously adopted.

Mr Carnegie moved, seconded by Mr. Withrow, that steps be taken for permanently establishing classes in mathematics, drawing and English grammar.—Carried.

Moved by Mr. Richard Davis, seconded by Mr. W. Halley, and

Resolved,—That a series of meetings be instituted for the purpose of giving members an opportunity to converse on subjects of general interest, for disscussion, essays, readings, &c.

After which the meeting adjourned.

FORTNIGHTLY MEETINGS AT THE TORONTO MECHANICS' INSTITUTE.

In the July number of this Journal, we called attention to a meeting of Members of the Toronto Mechanics' Institute, for the purpose of initiating a series of meetings for the discussion of matters of practical interest to Mechanics. On Friday, July 25th, the first of these very useful reunions was held, and a paper on the "*Heating and Ventilation of Buildings*" read by Mr. W. H. Sheppard. After reviewing at some length the effects produced upon the air of a room by the breathing of a large number of persons, and the inefficient methods of ventilation commonly adopted, Mr. Sheppard said:

"But within four walls the ventilation may be so managed that every individual may receive his quota of air directly from without, uncontaminated by the exhalations of others, warmed, if necessary, and even perfumed, if desirable.

"The arrangement necessary for this is that there may be, with a ready outlet for the foul air above, a provision made for admitting the air through numerous small apertures, distributed equally over the whole surface of the floor, it having been, if necessary, warmed, cooled or otherwise prepared in a chamber below.

"This system was adopted by Dr. Reid, in the ventilation of the temporary House of Commons, about 1835, and a similar plan was proposed by Mr. Sylvester for the new Houses of Parliament. The details of these methods are given in Tomlinson's Treatise on Warming and Ventilating, p. 214 & 238. The only defect in Dr. Reid's experiment was that the air in ascending carried with it some of the dust, &c., which was left in the carpet which it came through. This may be avoided in a seated room, by having for the lower back rails of the seats pipes of iron communicating with the space below, through the feet of the seats, and perforated every inch of their length, so that every one's share comes up directly to himself.

"This principle may be applied to an apartment of a dwelling house, where, to avoid the carpet, the air may be admitted by the base, in which a Torus moulding may be introduced, composed of a perforated iron pipe. Such rooms not being very large, or apt to be crowded, there is not the same necessity for having the perforations all over the floor. A hole at the top of the room, directly into the chimney, or, better still, a tube connecting the top of the room with the flue from the kitchen, where the fire is more constant, will give the necessary outlet.

"Any objection that may be made to an efficient system of ventilation, on the ground of its wasting the heat of an apartment, must be met by the consideration of its importance. The amount of human life that is lost by bad ventilation is worth far more than the extra expenditure of fuel which would have saved it."

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On Friday, August 8th, Mr. W. Edwards read a paper on "*The Warming of Buildings.*" The first part of Mr. Edwards' paper was devoted to a general outline of the different methods of heating or warming buildings pursued in this country, viz.: the open fire place, the close box stove, the hot air furnace, the steam heated pipes, the hot water pipes, and the steam heated chamber. The following interesting facts in relation to the consumption of fuel in several large buildings in the City of Toronto were introduced. With respect to heating by steam, the mode adopted in the Toronto Mechanics' Institute, Mr. Edwards states:

"This plan of heating is, undoubtedly, as safe, more economical, and a healthier mode than any we have yet considered, as adapted to large buildings. It is safe, because, but only one fire is required in the entire building, therefore, under easy control, and being placed in a fire proof vault in the basement, no danger from fire can arise; and if the boiler and apparatus be of the low pressure kind—an advantage this Institute has secured, the pressure of steam generally varying from 2½ to 10 lbs. on the inch—no danger of explosion or casualty of that nature need be apprehended. That this system is economical, is proved by our own experience, this building having been heated up to from 65° to 75° the entire winter, and the fire kept up continually, night and day, Sabbath and week days, with a consumption of about 35 tons of coal.

"It is healthier, because warmth is produced by radiation of heat from the steam pipes that pass through the rooms, and therefore does not burn or injure the atmosphere, as is done where the air is radiated from red-hot iron plates.

"This system, however, requires thorough ventilation of the room, and the introduction of fresh air in the vicinity of the pipes, or the same atmosphere will be simply re-heated and made to circulate through the room, the same as with the box stove.

"It is unnecessary for me to explain the working or construction of this apparatus, as it is in the build-

ing for any one to see; I would merely add, that it is easily managed by our housekeeper, and that the temperature is regulated with very little trouble, by means of valves in the different rooms of the building.

The Steam Heating Apparatus in this building, (the Toronto Mechanics' Institute and Music Hall) was supplied and arranged by Mr. Jas. E. Thompson of this city.

Hot Air Furnaces.—For extensive buildings this is probably the system most commonly in use for heating purposes. It is, however, open to one of the worst objections to the close stove, inasmuch as it is more liable to overheat *or burn* the air before introducing it into the room; and is also more expensive, both as regards the first cost of the apparatus and the subsequent keeping of it in repair, and also in the consumption of fuel.

"In two of the churches of this City, respectively of about the same capacity as our Music Hall, and in one of which the temperature is generally very low in the coldest weather, each consumed about fourteen tons of coal during the past winter. In one of them four Challenge Heaters are used, and in the other two McGregor Furnaces.

"I am informed that in heating the St. James' Cathedral for the past winter, with, I believe, "The Chilton Furnaces," sixty tons of coal were used. These Churches were only heated up for the Sabbath days, except to a very limited extent.

"In the Normal and Model Schools, heated by means of *Tiffany's* Furnaces, the consumption of wood is about 200 cords per annum; and the Model Grammar School, heated by coal furnaces, consumes about sixty tons of coal during the winter. These furnaces are all kept in operation for five and six days in each week."

"The cold air is introduced by conducting tubes from the outside of the building, generally from near the surface of the earth, into the air boxes of these furnaces; when to obtain a sufficient degree of heat it is often brought into contact with red hot iron plates or plates heated to such a degree as to destroy the vitality of the air, and cause headaches and other unpleasant sensations to the occupants of the room heated.

"These objections are, to some extent, obviated by placing a vessel of water, with a large amount of surface, for evaporation, in such a position that the heated air, before passing through the supply pipes into the rooms, must pass over it, taking up a certain amount of moisture with it in its passage."

"The last mode of Heating which I propose to notice is that of *Steam-heated Air Chambers*, placed in the lower portion or *basement* of the building. I am not aware of any buildings in Toronto being warmed on this principle, nor have I been able to find a description of such a system of warming in the works I have had the opportunity of consulting. It is, however, I have no hesitation in saying, the most complete and healthiest method of warming buildings of any yet brought under our notice, possessing all the advantages of hot air furnaces, and steam and hot water systems of heating without any of their disadvantages.

"The great advantage of this system is, that the air is always pure, if introduced into the building from a high elevation, as it invariably should be for all systems of heating, being thus comparatively free from the obnoxious gases and animal impurities resting near the surface of the earth, especially during the night.

"I have no doubt but a greater amount of fuel will have to be consumed by this system to produce the same amount of heat that is obtained by a smaller consumption of fuel in connection with the other systems of heating, except that of the open fire-place; but admitting such to be the case, there is no doubt of its being less injurious to health than any of the other modes, a consideration of the greatest importance to all who value their own or their neighbours' well-being."

Patent Laws and Inventions.

ABRIDGED SPECIFICATIONS OF ENGLISH PATENTS.

13. W. B. Pattrick. *Improvements in the manufacture of sugar, and in the apparatus employed therein.* Dated Jan. 1, 1862.

Here the patentee makes use of a closed vessel or vacuum-pan, and he heats the saccharine syrups or solutions therein to a low temperature, considerable below the boiling point, or 212° Fahr., by hot water, air, or vapour, caused to circulate in pipes in or around such vessel, or in the jacket or outer case thereof combined with the use of air heated to about the same temperature forced through openings in a pipe or pipes, applied so that the air may be distributed amongst, and pass through, the syrup or solution, and thereby aid in driving off the aqueous particles contained therein in the form of vapour, which are then drawn off by the air-pump or other means. By these means improved colour and increased amount of crystals will be obtained with less molasses or treacle.

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55. J. Stenhouse. *Improvements in rendering certain substances less pervious to air and liquids.* Dated Jan. 8, 1862.

This consists in the use of paraffine for rendering leather, thread, cord, ropes, and textile fabrics composed of cotton, linen, or wool, &c., less pervious to air and liquids.

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99. J. G. Marshall. *Improvements in the preparation of flax and other fibres previous to being spun.* Dated Jan. 13, 1862.

This invention consists in preparing the fibres of flax, hemp, and other analogous plants, by passing them in a wet state between a series of drawing rollers, to which an increasing draught is

imparted, previous to being spun, and where all the fibres are reduced to one uniform length and degree of fineness.

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139. T. Roberts and J Dale. *Improvements in the manufacture of gunpowder.* Dated Jan. 18, 1862.

This consists in a method of making gunpowder, whereby the patentees are enabled to use nitrate of soda instead of or in combination with nitrate of potash. This they effect by adding thereto a substance which will effloresce, so as to correct the tendency of the other material or materials to become moist. Of these substances they name, for example, the anhydrous sulphate of soda and magnesia.

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147. E. C. Nicholson. *Improvements in the preparation of colours suitable for dyeing and printing.* Dated Jan. 18, 1862.

Here the patentee takes red dye, such as is made from aniline or its homologue, and without the admixture of either aniline or its homologue, heats it carefully to a temperature, by preference, between 390° and 420° Fahr. The substance quickly assumes the appearance of a dark semi-solid mass, the red dye being transformed into a dark substance with evolution of ammonia. The mass he prefers afterwards to extract with acetic acid, using a quantity of acid about equal in weight to the amount of red dye treated, and this acid he dilutes with enough alcohol to make a dye of convenient commercial strength. The solution obtained is of a deep violet or purple colour, and may be used directly for dyeing purposes.

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156. C. T. Bousfield. *Improvements in machinery for makimg nails and spikes.* (A communication.) Dated Jan. 21, 1862.

This relates to a novel arrangement of parts, constituting an improved nail-making machine, in which two pairs of compressing rollers are used for tapering the ends of the metal rods fed into the machine to a suitable shape for forming nails or spikes, in combination with a cutter for severing such tapered ends from the rods, and a heading die for striking up the heads of the nails or spikes while the same are held firmly between nipping dies, the object being to effect in a rapid and economical manner the conversion of rods or bars of iron or other suitable material into nails or spikes.

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157. J. H. Rawlins. *Improvements in machinery used in the manufacture of paper.* (A communication.) Dated Jan. 21, 1862.

This consists in applying to a paper-making machine, wherein an endless web or woven wire is used, an apparatus consisting of a roller and a travelling blanket or felt to remove the wet web of pulp from the endless web of wire of such machine. By these means the web of wet pulp is caused to adhere to the travelling blanket or felt, and the two together are pressed between pressing rollers, and then the web of pressed pulp or paper is separate from the blanket and passes away to be dried, while the travelling blanket returns to the paper-making machine.

158. A. J. Martin. *Improvements in the treatment of fusil oil, and for various applications of the same to useful purposes.* Dated Jan. 21, 1862.

The patentee claims, 1. The combination and treatment or preparation of fusil oil with pitch or other hydro-carbons as described, for the manufacture of an oil or fluid to be used for illuminating purposes. 2. Treating fusil oil by subjecting it to the action of heated iron and steam as and for the purposes described.

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202. J. Brown and J. Davenport. *An improved lubricator for pistons.* Dated Jan. 25, 1862.

This consists of a lubricator having two thoroughfares open to the steam, with a direct communication through the tap or plug, which tap or plug may be placed in a horizontal direction.

PATENTS OF INVENTION.

Bureau of Agriculture and Statistics, *Quebec, 16th August*, 1862.

His Excellency the Gonernor General has been pleased to grant Letters Patent of Invention for a period of fourteen years, from the dates thereof, to the following persons, viz:

David Todd, of the Town of Windsor, in the County of Essex, for "A Railway Break of Guage Frustrator."—(Dated 27th May, 1862.)

Reverend John Harvy Rombough, of the Township of Osnabruck, in the County of Stormont, Minister of the Methodist Episcopal Church, for "A Self-feeding Trashing Machine, improved Separator and Fanning Mill."—(Dated 27th May, 1862.)

Thomas Robson, of the Township of Brantford, in the County of Brant, Miller, for "An Improved Feed Mill," a machine for reducing to a fine state Bark, Indian Corn in the ear and other substances, and for cracking for feed coarse grains."—(Dated 27th May, 1862.)

James E. Mitchell, Machinist, and William Depew, Tin-Smith, both of the Town of Paris, in the County of Brant, for "Improved Balance Gate." —(Dated 3rd June, 1862.)

Joel Sylvester Warner, of Cornwall, in the County of Stormont, Watchmaker, for a Churn called "The Peoples' Self-acting Churn."—(Dated 3rd June, 1862.)

Robert Metcalfe, of the Village of Carleton Place, in the County of Lanark, Carpenter, for "Certain improvements in the construction of Churns." —(Dated 3rd June, 1862.)

Aaron Hawley Scott, of the Village of Tilsonburg, in the County of Oxford, Cabinet Maker, for "A new mode of applying power to Machinery, by means of rotary motion with a slide lever."—(Dated 3rd June, 1862.)

George Martin, of the Village of Oshawa, in the County of Ontario, Joiner, for a new Fanning Mill or Wheat Separator, called "Martin's Improved Wheat Separator." (Dated 3rd June, 1862.)

Charles H. Waterous, of the Township of Brantford, in the County of Brant, Machinist, for "A Centripetal Churn and Centripetal Agitator for refining and fitting for use Rock Oil or Petroleum and Coal Oil."—(Dated 6th June, 1862.)

H. C. Drew, of the Township of Whitby, in the County of Ontario, Mechanic, for "An Improved Waggon and Carriage."—(Dated 9th June, 1862.)

Albert Bigelow, of the City of Hamilton, in the County of Wentworth, for "A new and improved compression Cock."—(Dated 9th June, 1862.)

Thomas Northey, of the city of Hamilton, in the county of Wentworth, Machinist, for "An improved expansion steam engine."—(Dated 9th June, 1862.)

Samuel Weaver, of the township of Humberstone, in rhe county of Welland, Artist, for a new process for taking photographs, called "Weaver's Process."—(Dated 9th June, 1862.)

Joseph Marks and Richard Eaton, both of the city of Hamilton, in the County of Wentworth, Mechanical engineers, for "An improved smoke stack and spark arrester for locomotive and other steam engines."—(Dated 9th June, 1862.)

Robert White, of the city of Kingston, druggist, for "An adjustable concave cleaner."—(Dated 9th June, 1862.)

H. B. Morgan, of the township of Tilsonburg, in the county of Oxford, Machinist, for "A Bee-Hive and miller destroyer."—(Dated 9th June, 1862.)

James Bowtell Burbank, of the village of Danville, in the county of Richmond, joiner, for "A new and improved washing and wringing machine."—Dated 18th June, 1862.)

Lorenzo Graves, carpenter and joiner, and Hollis Clark, wheelwright, both of the township of Barnston, in the county of Stanstead, for "A new sawing machine."—(Dated 18th June, 1862.)

Benjamin Thrasaer Morrill, of the township of Stanstead, in the county of Stanstead, farmer, for "An improved thrashing machine."—(Dated 18th June, 1862.)

Richard Lewis, of Melbourne, in the county of Richmond, carpenter, for "A new and improved churn."—(Dated 18th June, 1862.)

Richard Rogers, of the town of Whitby, in the county of Ontario, carpenter and joiner, "for A double attached clothes wringer."—(Dated 29th June, 1862.)

Hiram Joseph Livergood, of the township of Brantford, in the county of Brant, carpenter, for an improved Bee-hive, styled "Livergood's Bee-hive."—(Dated 7th July, 1862.)

John Battersby McNeail, of the Township of Westminter, in the County of Middlesex, butcher, for "A new and useful improvement in the manufacture of refrigerators."—Dated 7th July, 1862.)

William Holt, of York Mills, in the county of York, for "A ploughing, ridging, drilling, sowing and rolling machine."—(Dated 7th July, 1862.)

Thomas Gregory, of the township of King, in the county of York, yeoman, for "An improved Straw Cutting Machine."—(Dated 7th July, 1862.)

James Phillips, of the city of Toronto, in the county of York, Mariner, for "An improved self-heating smoothing Iron."—(Dated 7th July, 1862.)

John Abner Burton Hannum, of the town of Cornwall, in the county of Stormont, Cabinet Maker, for "A Double Dasher Churn Power."—(Dated 8th July, 1862.)

Nelson Simmons, of the township of Sophiasburgh, in the county of Prince Edward, Farmer, for "A Revolving Float Churn."—(Dated 8th July, 1862.)

John Bennett, of the township of Madoc, in the county of Hastings, Machinist, for "A combination Sieve."—(Dated 8th July, 1862.)

Leon M. Clench, of the village of St. Mary's, in the county of Perth, for a Hydropult to be called the "Pneumatic Repeating Hydropult."—(Dated 8th July, 1862.)

Daniel C. Ward, of Streetsville, in the county of Peel, Hotel Keeper, for "A new method of constructing Washing Machines with Wringer attached thereto."—(Dated 8th July, 1862.)

Thomas M. Bottomley, of the city of Toronto, in the county of York, Machinist, for "A Metallic Carriage and Waggon Hobb."—(Dated 8th July, 1862.)

Charles H. Waterous, of Brantford, in the county of Brant, Machinist, for "An improved machine for manufacturing the shoes of horses and other animals."—(Dated 8th July, 1862.)

Canadian Items.

THE CANADIAN OIL ASSOCIATION.

The owners of oil wells in Enniskillen have formed an Association for the sale of their oil. All the oil produced at the different wells becomes in effect the property of the Association, and when sold the proceeds are distributed amongst the various owners in proportion to the amount each contributes to the general stock, or in other words, to the yield of their wells. The Association recently despatched a committee of inquiry to the oil region of Pennsylvania, whose report from the *Oil Spring Chronicle* is subjoined.

"At a meeting of the Association last Friday evening, Mr. Richardson, of the committee sent to the oil region of Pennsylvania for the purpose of making observations and gathering information in regard to the oil business and its prospects there, made, substantially the following verbal report:—

Members of the Canada Oil Association; Gentlemen:—

I, as one of your committee, appointed by you to visit the Pennsylvania Oil Springs, will, in the absence of my associate, Mr. Sanborn, make only a verbal report. We visited the springs in Oil Creek only believing that we there obtained all the information in regard to the oil trade which could be of any particular advantage to you who are engaged in the trade here. We found upon arriving at Titusville, that all the oil wells in that vicinity are dry, or in other words had ceased to flow as they once had and that the nearest well to that point now flowing, was six or seven miles down the creek. This first well is called the Sherman well, and is one of the best which we visited. It is claimed to flow 500 barrels per day, and I think not over estimated. The territory which is at present producing oil to

any considerable extent, does not extend more than some four miles down the creek from the Sherman well. Below that to the mouth of the creek, the wells have principally ceased to flow, as about Titusville. We found but few wells claimed to flow equal to the Sherman well. Some few claimed to flow 200, and a number claimed to flow from 10 to 50 barrels per day. From our best observation, and the most reliable information we could obtain, we came to the conclusion that the present yield of oil on Oil Creek, and indeed of all the Pennsylvania springs, is not over one fourth of what it was last winter, that is for each 24 hours. The fact of this great falling off of the supply is not attempted to be concealed by the oil men there. Refineries, both large and small, are being erected, a branch railroad constructed to the springs, and various improvements being made, which convinced us that all interested in the oil trade have a deep abiding faith in a large supply to be drawn by pumping after the veins cease to flow by the pressure of the gas. Whether such will be the case is hard to tell. We asked the opinion of many, and were generally answered, "the wells have not been tested, but we think they will pay fair quantities by pumping." There is more uncertainty in obtaining a flowing vein there than here, and the cost much heavier. The veins there are not generally less than 500 feet in the rock. The oil is accompanied by much more gas in the flow than ours, consequently it is lighter and of less value, provided it costs no more to deodorize ours than theirs. We found the market price at the wells from 50c. to 60c. per barrel, but the stock was light and buyers plenty. We found a large quantity stowed in tanks covered in the earth, which is not in the market at these low prices. Pennsylvania oil producers once realized large prices, and they confidently expect those prices to return, and that ere a great while. They reason in this way. The demand is much larger than one year ago, and the supply much diminished, hence, the price must go up. This reasoning to my mind is logical, and I have no doubt that they will realize their most sanguine anticipations within the next two years at farthest.

The practice with us of shutting off flowing veins, is not followed in Pennsylvania, consequently they are subjected to heavy expenses in storing, or are compelled to sell at low prices, or let their oil waste. Again, transportation to shipping points costs them from twice to six times what it does us, hence we have nothing to fear from competition with them in the markets of the world; while our price is not more than double theirs at the springs. I will now make a few suggestions upon the probability of the early exhaustion of our great reservoir of oil in Canada, not as legitimately a part of my report. If the theory is a correct one, that petroleum is a product of coal, and our supply was produced from the Pennsylvania coal beds, the strong probability is, that our reservoir reaches to a great depth, and that we have as yet only drawn a little from the surface. Or again, if it is not the product of coal, but produced by agencies now at work, we may never be able to fully exhaust our supply. But insomuch as these are all uncertainties, I would advise that we proceed just as though we knew we had tapped the only body we will ever find, and that it will exhaust within five years at most."

THE CANADIAN NATIVE OIL COMPANY.

The cause of the decline in the yield of the Pennsylvania wells is very probably due to the exhaustion of the gas which forced up the oil to the surface. We do not agree with the "uncertainties" spoken of by the Committee of the Canadian Oil Association which precedes this notice. Petroleum is neither derived from coal, nor is it of recent origin. It was formed long before the coal, and is the result of the decomposition, under pressure, of an infinite number of oil-yielding animals which swarmed in the seas of the Devonian period, long anterior to the coal. The decomposition of marine plants may have given some oil to the rocks of Canada and the United States, which are saturated with this curious substance. The shale beds of Collingwood furnish an answer to those who object to the infinite number of animals it would require to produce the oil locked up in the earth. Those shale beds are composed almost altogether of the remains of Trilobites—they extend from Lake Huron to Lake Ontario, and far west and east of those lakes. The oil-bearing rocks of Canada were once a vast coral reef, extending from the Gulf of Mexico to Lake Superior. There is the best ground for belief that the supply of oil will last for a long period, and that new discoveries will be made in different localities. But as soon as the motive power which forces the oil to the surface is exhausted by finding free access to the air, recourse must be had to pumping, and the sinking of the necessary deep wells, will soon throw out all those owners of wells who are not possessed of capital. Deep shafts will eventually have to be sunk, and the oil will continue for a very long period to flow into the wells, but the cost of pumping will be so small that the price of oil may not rise much beyond its present market value. That value will be of course determined by the cheapness of other illuminators, and as the supply will doubtless be ample, we do not anticipate any considerable rise in price. The London Company have made purchases of land, we understand, in different parts of the peninsula, but it does not appear that these purchases have been made with a knowledge of the geological formation of the country or of the distribution of the *accumulations* of oil. The area of oil or petroleum yielding rock is very great in Western Canada, extending over the whole region occupied by the Corniferous limestone, but the fissures in which the oil has accumulated, are probably found only in the main and subordinate anticlinal axes which run through the western peninsula. If the land purchasers for the company have not had this remarkable geological peculiarity prominently and constantly be-

fore them, in vain are their purchases of "oil lands," they may have secured good farm lots as the country settles up, but when they come to bore for oil, the returns for their labour may be chiefly couched in the words *non est inventus.*

The following is from the Prospectus of the Canadian Native Oil Company, (limited). Incorporated under the Joint Stock Companies Acts 19 and 20 Vic., Cap. 47, by which the liability of each Shareholder is strictly limited to the amount of his Shares. Capital £100,000, in 20,000 Shares of £5 each, 10s. on Application, and 10s. on Allotment. No Call to exceed £1 per Share, and an interval of not less than Three Months between each Call.

Directors.—John Arthur Roebuck, Esq. M.P., Chairman, Ashley Place, Westminster; Adolf Ellisen, Esq., Firm of Ellisen & Co., 21 Moorgate Street, Director of the Metropolitan and Provincial Bank; The Hon. Mr. Justice Haliburton, M.P., Gordon House, Isleworth, Chairman of the Canada Agency Association; John Henry Lance, Esq., Director of the London and South African Bank; F. John Law, Esq., The Holmwood, Dorking, Chairman of the London General Omnibus Company; Lt.-Colonel G. H. Money, N.E.L.R., 2 Bedford Square, and 9 Berkeley Street, Berkeley Square; with power to add to their number.

Bankers.—The City Bank. *Brokers.*—Sir Robert Carden and Son, 2 Royal Exchange Buildings. *Auditors.*—Henry Kingscote, Esq., Samuel Burgess Gunnell, Esq. *Solicitor.*—J. F. Elmslie, Esq., 10 Lombard Street. *Consulting Engineers.*—Messrs. Phillips and Darlington Moorgate Street Chambers. *Secretary.*—Mr. David Nisbett, Jun. *Temporary Offices.*—27 Gesham Street.

The directors state in their prospectus, that in order to show the comparative advantage of this Petroleum or Rock Oil over all other burning Oils, the following statement, the result of careful experiment and calculation is submitted:—

Description of Oil.	Price per Gallon.		Intensity of Light by the Photometer.	Amount of Light from equal quantity.	Cost of an equal quantity of Light in decimals.
	s.	d.			
Petroleum or Rock Oil	2	0	13·70	2·60	2·00
Sperm	7	6	2·00	·95	20·00
Camphine	5	0	5.00	1·30	10·00
Rape or Colza	4	0	2·10	1·50	6·50
Lard	4	0	1·50	.70	14·50
Whale	2	9	2·40	·85	8.25

PETROLEUM GAS.

The Stevenson House, St. Catharines, is now lighted with Petroleum gas. The light is very white and brilliant; and although one foot burners only are used, the illuminating power is fully equal to that of a four foot burner supplied with the coal gas in ordinary use. There is no smoke or smell perceptible during the burning; and as the works are situated some short distance from the hotel, the odor of Petroleum is not apparent. The works are constructed according to Messrs. Thompson & Hind's patented process. The success which has attended the lighting of the Stevenson House, has already induced other parties to adopt Petroleum gas. Among several others, we notice a large factory at Dundas, a factory at Hespeler, the Rossin House at Toronto. The introduction of Petroleum gas into the Rossin House will be a great saving to the proprietors. They consumed last year 578,000 cubic feet of gas, which cost \$1,734 @ \$3 a thousand feet. This year the Toronto Gas Company propose to let them have the gas at \$2 50 a thousand, which, for a consumption of 600,000 feet per annum, amounts to \$1,500. Mr. Thompson's works will cost them about \$1,500, and they will cover, by the use of the Petroleum gas, the entire expense in less than two years. Including every outlay, interest on capital, &c., the cost of the gas will be only \$1 70 a thousand feet, assuming that 10 gallons of oil are used for making that quantity of gas, although, if good oil is available, 7 gallons are abundantly sufficient in the process employed. One foot burners are used instead of three or four foot burners, hence the quantity of gas consumed is less than one-third. So that the actual cost per thousand, compared with coal gas, is about 60 cents against \$2 50 a thousand feet.

FLOWING WELLS AT ENNISKILLEN.

On Wednesday, the 13th August, Mr. John W. Sitton was rewarded for his labour by striking a large vein of oil at the depth of 153 feet in the rock. The oil immediately rose to the surface, filling the surface well (51 feet), and commenced flowing. The yield is variously estimated at from 1,000 to 1,500 barrels in 24 hours. We are glad to be able to record this, as Mr. Sifton well deserves his prize.

Another.—We learn that on Tuesday last, Mr. Wm. Webster tapped a large vein of oil at the depth of 153 feet in the rock. The flow of this well, although not as large as the one mentioned above, is amply sufficient for all practical purposes, and is as great as can be taken care of. It is estimated at about 800 barrels in 24 hours.

Another—On Wednesday morning (Aug. 20), still another flowing well was struck. The fortunate ones this time are Messrs. J. H. Fairbanks and J. H. Eakins. The depth was but 116 feet in the rock—the shallowest one yet struck in the diggings. The yield is said to be about 500 barrels in 54 hours.

The Oil Springs *Chronicle* of Aug. 28th contains the announcement of another flowing well struck by Mr. E. T. Soles the Editor of the Chronicle.

Sale of 2,500 Barrels of Oil.—The Canada Oil Association sold last week 2,500 barrels of crude oil to one firm in Montreal. We understand that they have received orders for another 2,500 barrels for the same market. This is encouraging.—*Oil Springs Chronicle.*

CENSUS OF CANADA.

ACCORDING TO ORIGIN.

Natives of Canada not of French origin.	1,037,170
" French origin	880,607
" Ireland	241,423
" England and Wales	127,429
" Scotland	111,952
" United States	64,399
" Prussia, German States and Holland	23,855
Indians	12,717
Natives of Nova Scotia and Prince Edward's Island	5,360
" New Brunswick	4,066
" France	3,061
" Guernsey, Jersey, and other British Islands	1,157
" Newfoundland	719
" Switzerland	698
" West Indies	669
" Sweden and Norway	590
" East Indies	252
" Russia and Poland	227
" Italy and Greece	218
" Spain and Portugal	151
" All other places	669
Born at sea	384
" at places not known	1,809
	2,506,755
Coloured persons included in the above.	11,413

CENSUS ACCORDING TO RELIGION.

Belonging to the Church of Rome	1,200,865
" " England	374,987
Wesleyan Methodists	244,246
Free Church of Scotland	157,813
Established do.	132,649
Episcopal Methodists	79,152
Baptists	69,310
United Presbyterians	56,527
New Connexion Methodists	29,492
Lutherans	25,156
Other Methodists than the above	24,204
Men of no religion	18,850
Creeds not classed	14,962
Congregationalists	14,384
No creed given	13,849
Protestants	10,098
Menonists and Tunkers	8,965
Bible Christians	8,085
Quakers	7,504
Christians	5,316
Universalists	4,523
Disciples	4,152
Second Adventists	3,355
Unitarians	1,284
Jews	1,241
Mormons	77
	2,506,755

The population of the principal cities is as follows:—

Upper Canada.		Lower Canada.	
Toronto	44,821	Montreal	90,323
Hamilton	19,096	Quebec	51,109
Kingston	13,743	Three Rivers	6,058
Ottawa	14,696	Sherbrooke	5,899
London	11,555		

PERSONAL CENSUS OF THE BRITISH NORTH AMERICAN PROVINCES.

Canada	2,506,755
New Brunswick (over)	250,000
Nova Scotia	330,000
Prince Edward's Island	80,857
Newfoundland	122,638
Total	3,290,250

MANUFACTURES IN MONTREAL.

The manufacture of boots and shoes in Montreal has risen to great prominence, and many persons engaged in the business have rapidly acquired wealth. The wholesale trade is in the hands of some six or seven houses. The amount of capital invested in all the works is about $750,000, and the number of boots and shoes of all kinds manufactured averages 1,000,000 pairs. This branch of trade gives constant employment to about 1100 persons, many of whom, of course, are women and children. There are besides the following manufactures in operation:—India rubber shoes, &c., foundries, threshing machine factories, steam sawmills, &c. The sugar refinery of Mr. Redpath is the largest factory in Montreal, and deserves special mention. Its large pile and tall chimney are visible a long way off from the city. The principal building is of stone and brick, seven stories high, the whole of the floors comprising an area of 11,766 square yards. Besides this there are two brick warehouses attached, affording storage for 8,000 barrels of refined sugar and 2,500 hhds. of raw sugar. There is also attached a range of brick buildings, 236 feet in length and two stories high, containing the gas house, the bone house, blacksmith's, carpenter's, machinist's and cooper's shop, and stable; cost £45,000. The machinery is propelled by a steam-engine of 50-horse power, the boilers being equal to 150-horse power. 150 to 170 men are employed upon the premises, but a good deal of work is done elsewhere. The wages amount to £11,000 per annum, the total expenses of the establishment being £33,000 per annum. The present product is about 3,000 bbls. of refined sugar per month, and the production could easily be doubled if the demand required it. It is all sold in Canada. This factory is the first and as yet the only one of the kind in the Province.

To show that we also support to some extent articles of luxury, says the correspondent of the *Canadian News*, I may mention that there are in this city five piano manufactories, which annually turn out about 185 instruments. This year there has been a slight decrease in the number produced

in comparison with the preceding one. The amount of capital invested in this branch of business is about $40,000 to $50,000, and the number of hands employed is about 60 men, who earn from $6 to $15 per week each, according to ability.

GROWING TRADE WITH CONTINENTAL EUROPE.

In the present year nine ships have already sailed for German ports—Stettin, Hamburg, and Bremen—with cargoes of Timber and Rock Oil.

Stettin	1 ship,	Oak.
Hamburg	3 ships,	Oak and Pine.
Bremen	4 ships,	Red and White Pines, Walnut, &c., from Chatham.
"	1 ship,	with Rock Oil.
Total	9 ships.	

LOSSES ARISING FROM BAD FLOUR BARRELS.

The following remarks on Flour Barrels, from the *Montreal Witness*, are well worthy of the attentive perusal of millers and exporters of flour:—

"We wish to draw the attention of millers to the important subject of flour barrels, as many of the difficulties and losses in flour transactions grow in one way or another out of imperfect barrels. If barrels be made too slight, they cannot be transported in good order, and sometimes they get iuto such a state that no sea captain will sign a bill of lading for them. Such barrels get loose, the flour dusts through the staves, the heads of some fall out, and the flour turns out short weight, entailing the expense of filling up, which involves a loss of from 15 to 20 cents a barrel, besides the disgrace of being published for short-weights.

"Barrels that are heavy enough may be made of wood only partially seasoned, in which case also they become loose, and the above results occur as well as one to which we wish to draw attention. A barrel made in winter, of wood only partially seasoned, will lose 1½ lbs. by this time. Suppose it weighed 21 lbs. when made and branded, and 196 lbs. of flour was put in, the gross weight would be 217 lbs.; but the barrel itself loses perhaps 1½ lbs. in weight, so that the gross will be only 215½ lbs., from which we deduct the marked tare of 21 lbs., and only 194½ lbs. remain as the net. The Inspector will reject this flour as short weight when all the time there are 196 lbs. in the barrel. This strikes us as being a mistake either in the law or the Inspector; because, no flour can be called short-weight if there be 196 lbs in the barrel. It is however to be observed, that no barrel should be scribed until seasoned; and, we may add, no barrel should be less than 20 lbs. weight, but rather a little more:—for 20 lbs. is always deducted in Liverpool as Tare, and Canada loses an average of three or four pounds of flour per barrel, on a great proportion of her shipments."

CENSUS IN NEW BRUNSWICK.

The population of New Brunswick has increased 30 per cent. during the last ten years, and the number of inhabitants exceeds 252,000. Of these 128,593 are white males and 120,661 white females, 625 Indians, and 587 females, making a total of 129,948 males and 122,099 females. The per centage exceeds that of Nova Scotia by 10 per cent., and Lower Canada by 6; it nearly equals the whole of Canada, whilst it has made great advances over several states in the adjoining Republic.

The Roman Catholics are the largest body of Christians in the Province, numbering 85,258, a third part of our whole population. The Baptists united have 57,730; Episcopalians, 42,776; Presbyterians, 86,072; Methodists, 25,637.

Of manufactures, there are 80 steam saw mills, 609 water saw mills, 6 steam grist mills, 273 water grist mills, 21 water oat mills, 22 steam tanneries, 10 water and 94 manual do., 21 steam foundries, 79 weaving and carding water mills, 5,134 hand looms, 9 breweries that produce 322,040 gallons, &c. Since 1851 a great increase is observable in mineral wealth, especially in coal, as last year there were 18,244 tons raised, while in 1851 there produced only 2,842.

Photography.

MR. DE LA RUE'S PHOTOGRAPHS OF THE SUN.

Arago, in his elegant and popular work on Astronmy, translated by two eminent fellows of our Society, states that MM. Fizeau and Foucault, in 1845, obtained a photographic image of the sun, and two spots on its disk, delineated with much accuracy; but, however this may be, it is certain that no uniformly successful method of taking images of the Sun has been devised until Mr De la Rue took up the problem for investigation.

Yet great as have been the difficulties in obtaining a really accurate and available picture of the Moon they sink into significance when compared with those which had to be overcome in the photography of the Sun, for to obtain any automatic pictures of the Sun's photosphere available for practical purposes, it was found necessary to institute a series of preliminary experiments before actual operations could be successfully commenced. At first nothing but burnt-up and polarized pictures could be obtained by any method that had hitherto been devised, or with any the least sensitive of the media that could be procured. Now, with the help of the Kew photoheliograph, as devised by him, and described in vol. xv. of the 'Monthly Notices,' *heliography* is the easiest and simplest kind of astronomical photography. The method devised by Mr De la Rue will enable any photographer of common average skill to take excellent heliographs. Professor Selwyn, of Cambridge, succeeds in getting pictures of the Sun with the apparatus made for him by Mr Dalmeyer, after the pattern of the Kew photoheliograph.

Mr De la Lue announced at the last Meeting of the Society, that by applying the stereoscope to the examination of the Sun's disk, as he had done in the case of the Moon, he had discovered, that faculæ on the surface of the sun are to be found in the outer or or highter regions of the solar photosphere.

I ought not to conclude without alluding to Mr. De la Rue's observations on the solar eclipse in 1851; and of the solar eclipse in 1860 *four* small pictures were taken dnring the totality by Professor Monserrat, under the direction of MM. Aguilar and Secchi, at Desierto de las Palmas, in Spain.

Mr. De la Rue, during the progress of the same eclipse, took many large and exquisitely defined pictures, and secured two during the totality. I have no need to enter into details, as he has already described at several meetings of this Society the numerical results that follow from the discussion, and the comparisons of the photograghs which he took on that occasion. A paper, giving the result of his labours during the expedition to Riva Bellosa has been presented to the Royal Society.

Mr De la Rue has invented an ingenious micrometer, lately exhibited at one of our meetings, by means of which he fully confirms the hypothesis that the coloured protuberances belong to the Sun, and renders it almost certain that the commonly received diameters both of the Sun and Moon require a correction.

More recently still, photographic pictures of the Sun have been obtained by Mr De la Rue, not only exhibiting its well known mottled appearance, but showing traces of Mr Nasmyth's "willow leaves" and by the aid of stereoscopic pictures rendering it certain that the faculæ are elevations in the Sun's photosphere.

I need not enlarge on the wonderful discoveries which have been made and the astonishing results that have been obtained by Newton and his successors in this, the most fertile and exact of all the applied mathematical sciences. Neither would it bebecome me, an humble but zealous worshipper of science, to hazard conjectures as to thr *future progress* of *astronomy*. And yet I cannot refrain from expressing my belief that the success already achieved by our friend warrants us in entertaining the hope that before long he will be able, with the aid of stereoscopic pictures, to exhibit to us the rose coloured prominances depicted on the sensitive plates as plainly as the faculæ have already been photographed.

The depths and the successive strata of those strange interlacing outliers within the solar spots may be brought into tangible view. The different plains of *Saturn's* rings will also come into relief, the belts of *Jupiter* may be manifested as portions of his dark body, and ere long the mountains and elevated continents of *Mars* will rise up into solidity before our delighted gaze.

I may also, perhaps, be permitted to remark, that while our great national and public Observatories—indeed I ought to say, those of the civilized world as well—are day by day adding to that enduring record of the transient phenomena of the heavens, which will enable future ages to reach the final finish and last perfection in the calculation of the tables of the motions of the moon and the planets, to eliminate any element of error, however minute, and to detect any latent disturbing force however feeble its effect, yet it is to *private Observatories* and to observations made in the remoter regions of starry space that we are chiefly to look for new discoveries. It augurs well for the future that there is no lack in our own day of such establishments, or of accomplished observers to use them. It is almost, if not altogether, needless to bring before you the names of Admiral Smyth, or Lord Rosse, or Mr. Lassel, or Lord Wrottesley, or Mr. Dawes, or Mr. Carrington, and a host of others familiar to many of you. The elliptic motions of binary stars round their common centre of gravity, the colours of others, the discovery of new planets, the calculation of cometary orbits, the laws of change in the *variable* stars, the sudden burst upon the sight of some stars, and the gradual evanescence of others, will afford for many generations suitable and exhaustless subjects of sustained astromonical research. The instant splendour and gradual decay of certain stars is one of the most wonderful facts recorded in the history of astromony. In 1572 Cornelius Gemma observed a star in the chair of *Cassiopeia*, transcending *Venus* in brightness. It was Hipparchus who first, I believe noticed the sudden appearance of a star of singular briliancy before unknown. By this strange discovery he was urged to construct a Catalogue of Stars visible to the naked eye, "that posterity might know whether time had altered the face of the heavens."

The art of photography is of the very highest importance in the promotion of exact science. It stereotypes, so to speak, for the use of all time to come, the present aspect of the heavens.

As astronomical observations ranged in tables record the present positions of the heavenly bodies, so photography registers their present aspect, It may be that the pictures of the Sun now taken will enable future ages to test the prediction of the poet—

> "The Stars shall fade away, the Sun himself
> Grow dim with age, and Nature sink in years." *

Selected Articles.

FISH CULTURE.

The remarkable facilities which nature has afforded Canada for Fish culture, may make it become the most extensive fish-producing country in the world. Besides the unequalled system of rivers which flow into the St. Lawrence and its great tributary, the Ottawa, we have the vast extent of lake coast which reaches from Kingston to Fort William. We enjoy the grandest series of fresh water reservoirs in the world, and so situated that they may, on our north shores, become most productive in fish, and eventually yield not only large revenues to the Government, but also give employment to a very useful and hardy class of population. In another part of this number we have referred to this subject. It is sufficiently important to engage the serious attention of all who

* Abbreviated from President's address, Photographic Journal.

are anxious to develope the material resources of the country. The present notice refers to the Salmon; in subsequent numbers we shall introduce the result of successful experiment with several species of fresh water fish suitable to our lakes and rivers.

The following extracts are from a very instructive book entitled—"The Natural History of the Salmon," by William Brown.

"In the spring of the year 1854, Mr. Buist, the conservator of the Tay, obtained some ova, nearly ready for hatching, from a ford on the river, and placed a dozen of the grubs of the May-fly (*ephemera*), taken from the same bed, along with them in a vessel, which was supplied with water by a syphon of thread. In a few days the grubs had devoured one of the eggs, and in a few days more the whole were devoured; but, previous to that time, two or three of the grubs left their covering, and came forth as the May-fly. We watched them carefully while in the act of feeding, and found five or six of the grubs firmly fixed to an ovum, which they never left until totally eaten up. These animals are not the scavengers of the river, for, in this instance the ova were alive. Again, in a small but complete artificial rearing apparatus, which we have had in operation for many years, and which is supplied with filtered water, we deposited in two boxes, on the 26th of November, 1859, a quantity of salmon ova, fecundated by the milt of a male salmon, and on the 30th of the same month a small quantity of sea-trout ova, fecundated by the milt of a male salmon also. The progress made by both was very satisfactory; the temperature of the water was 40° when the ova were deposited—never falling below 36°, and by the 1st of March, the eye and round form of the fish could easily be detected in both kinds, by the naked eye, and an ovum, when put in the hollow of the hand, would turn itself round. Peter Marshall, the keeper at the Stormontfield pond, who was in the habit of examining them regularly, stated that they were about a fortnight earlier than the ova at that place, which had been deposited at the same date. But about this time, on account of a deficient supply of filtered water a quantity of unfiltered water was allowed to enter the pipe; this water contained a large amount of the larvæ and grubs of insects, particularly of a small black water beetle and by the end of April all the ova were devoured. Their method of procedure was as follows: the grub fastened on a live ovum, and pierced a hole in the shell, the colour instantly changing from a salmon colour to opaque white: the egg was devoured at leisure afterwards.

"The fish lies in the shell, coiled round in the form of a bow, and the greatest strain being at the back, it is the first part that is freed; and, after a few struggles, the shell is entirely thrown off with a jerk. The appearance of the fish at this stage of its being is very interesting; what is to be the future fish is a mere line, the head and eyes large, the latter very prominent. Along the belly of the fish, from the gills, is suspended a bag—of large dimensions in proportion to the size of the fish. This bag contains a yolk which nourishes the fish, for six weeks after which they must be fed. For a few days after hatching, the two dorsal fins are apparently joined, and the two pectoral are very large in proportion to the rest of the animal. The little creature, not requiring to seek its food, moves very little, and, when it does, swims mostly on its side, owing to the large size of the bag; this gradually becomes absorbed, and in a short time the fins get separated, and the fry assumes the general aspect of a fish. In its first stage it is translucent, but in a short period it takes on the parr colour, and the transverse bars can be easily seen, and the tail begins to get much forked. At the bag stage of their existence they are very easily injured; a displaced stone in the gravel amongst which they are lying coming against them destroys them; and although they are no longer the pray of insects, all kinds of fish and fowl are their enemies, and great must be their destruction in rivers where there enemies are numerous. As we have previously stated, in about six weeks the bag is absorbed, and the fish is fingerling or parr, from one inch and a half to two inches long.

At the end of a year the fry had become parr, and in May, 1855, smoults. At the beginning of this month the sluices were withdrawn, and the fish allowed to depart; but scarcely any showed an inclination to pass into the river until the 24th of that month, when the exodus began, and a shoal came down to the marking-box. Here 1,300 fish were marked by cutting off the second dorsal fin; but a much larger number escaped unmarked. On the 7th of July, the first marked fish, in the form of a grilse, weighing 3lb., was captured; and this was soon followed by several others caught during this month, weighing from 5 lb. to 9½ lb. Making allowance for grilse taken with marks, and not reported, it is calculated that at least 4,000 were added to the stock in the river from the breeding ponds. Thus the first experiment proved entirely successful; and although some of the seasons since 1853 have been very unfavourable to pisciculture, yet the general results are higlhy satisfactory.

"We also learn that the ova of salmon, at least, are not fecundated until they leave the fish, and that the male parr is as fit to continue its species as the adult male salmon, but no female parr has yet been discovered with roe developed. The experiment has also established the fact that there is no difference in the length of time taken to hatch, or the appearance of the fry after hatching, up to the smoult state, between the fry of salmon, grilse-salmon and grilse, salmon and parr, or grilse and parr. It has also been ascertained that the fry of the first year that assumes the migratory dress, are composed of both sexes in nearly equal proportions, and it makes no difference whether the fry be reared from salmon or grilse, or salmon and grilse, or salmon and parr, or grilse and parr. Why those that remain behind for another year do so, and a few no doubt of each hatching for a year more, we cannot tell, but such is the fact; and the best reason we can venture to give is, that by this means the river has always fish in it, that will migrate at least a month sooner in the spring than the fry of the first year, and also that male parrs will always be at hand in the river during the spawning months in a fit condition to supply the want of male salmon, when that occurs, which is a wise provision in nature, as many females in small and distant tributaries might be left without a

mate, if there were no parrs, male parrs having been proved to be in a breeding state at that time. The question of salmon spawning in the sea has also been settled—no salmon will spawn in the sea if it can help it—as salt water destroys the ova. The experiment has demonstrated the practicability of rearing salmon artificially, fit for the market, within twenty months from the deposition of the ova—and the great value of artificial production—as it is ascertained that not above ten per cent. of the ova deposited in the boxes is lost, and not above twenty per cent. additional, but arrives at the smoult state and is sent into the river—(the keeper's report is much under this) ;—whereas it is generally supposed that not above 1 in 1000 of those naturally deposited in the river ever arrive at the smoult state, being the prey of fowl, fish, insects, and many other enemies. It has been also been noticed that not a few of the ova deposited in the natural way miss the fecundating milt, and are lost; and when we take into account the great quantity that is deposited during floods on places that are left dry when the river falls in, and also the numbers of redds that are sanded up by large spates, we need not wonder that if only 1 in 1,000 should ever become marketable. The keeper this season—January 1862—has been employed for many days carrying the spawn which has been deposited in places of the river which have been left nearly dry, by the river falling, and spawn sanded up by the spates, and placing it in the boxes to be artificially reared. Hence the obvious advantage of artificial breeding to rivers that have been overfished, or to those that have been destroyed by poaching and obstructions on the river to the ascent of the spawning fish, etc."

A COURSE OF SIX LECTURES

On some of the Chemical Arts, with Reference to their progress between the Two Great Exhibitions of 1851 *and* 1862, *by Dr.* Lyon Playfair, *C. B., F. R. S., Professor of Chemistry in the University of Edinburgh.*

Lecture II.

Distillation of Coal.—Showing how the former Waste Products in the Manufacture of Gas have been Economised. Salts of Ammonia, Benzol, Tar Colours, &c.

(*Continued from page* 243.)

But I must go faster with my subject. I now pass to coal-tar.

Now, coal-tar is a very complex body. It contains a large number of substances, some of which are volatile, others more difficultly volatile, and others not at all volatile in the ordinary sense of the word.

I have here a retort filled with tar, and I am now going to pass through that a current of steam; and you will see that after a little when it passes through freely it will distil over along with the water, and that this water will contain, swimming on its top, a certain quantity of naphtha. The steam which passes through the tar will take away the more volatile portions of the tar and condense it upon the top under the name of naphtha. What remains behind is a mixture of what is called dead oil and pitch. This dead oil is afterwards distilled off, and what remains behind in the retort is finally pitch.

In distilling it in this way we obtain from 100 parts of coal-tar, of naphtha 9 parts, of dead oil 60 parts, and of pitch 31 parts, so that there are various substances obtained. I have only time, however, to deal with the naphtha. Now, naphtha itself, or the substance which we get over by distilling the tar with steam, is a general word also. I have placed on this diagram the products of the tar. Crude naphtha contains all these substances which are written down there; but I will refer you at present to the upper division. The crude naphtha contains, first, basic oils, or oils acting as bases; secondly, acid oils, or oils acting as acids; and thirdly, neutral hydro-carbons. You will notice in the diagram, as in all the diagrams which we shall use, that whenever we have a body acting as a base, we colour it blue to show that it is a base, like this soda which coloured red water blue; when it is an acid, we colour it red; and when it is neutral we colour it green; so that when you find a body written red, it is an acid body; and when it is green it is a neutral hydrocarbon.

This naphtha is now taken and purified and clarified. There is added to it sulphuric acid. The sulphuric acid takes up the basic oils which are at the top, and unites with them and forms salts—sulphate of these bases. (We will complete our distillation of the tar afterwards. It is making too much noise for me to have my lecture accompanied by it. We will finish it after the lecture, and you shall see the products in the next lecture.) The sulphuric acid unites with the basic oils and produces this "sludge," as it is termed by manufacturers—the bases united with the acid.

Now, these are extremely valuable, and it is from them that these coal-tar colours, which I am going to speak of presently, are obtained; but they are entirely lost by the manufacturer. They will probably be saved afterwards, but at present they are thrown away as a sort of tar. The first things that we obtain of any advantage are the acid oil and the naphtha. The naphtha itself—the crude naphtha of which there is a specimen there, is employed at once, without any purification, for the purpose of making india-rubber waterproof coats and similar articles. But it is purified for various very important purposes. When the most volatile portions are collected, what comes over are the acid oils. Now these acid oils consist of two acids—carbolic acid and cressylic acid. Carbolic acid has the formula $C_{12}H_6O_2$; and the cressylic acid is what is called a homologue of the other, or contains C_2H_2 more. It consists of $C_{14}H_8O_2$. Common creosote is a mixture of these two acids. This carbolic acid which forms common creosote, is, after purification, and when perfectly dry, a solid; and it is this beautiful acid which I have present here. I see the manufacturer of this very specimen in the room, and I wish he was lecturing here to tell you more about it than I can. Before he sent me this beautiful specimen, I had never seen it in commerce solid; it is generally liquid. This carbolic acid when united with lime forms one of the most powerful disinfectants we have, which I will show you in my last lecture, when we come to the subject of sanitary chemistry. When this acid is treated with nitric acid it loses part of its

hydrogen, and that hydrogen becomes replaced by peroxide of nitrogen, a lower oxide of nitrogen than nitric acid. When it is treated with nitrogen three of these go away, and the hydrogen is replaced by what is termed a compound radicle—a body which plays the part of hydrogen, and which forms this yellow substance called carbazotic acid. Carbazotic acid is carbolic acid, three of whose equivalents of hydrogen, have been substituted by three equivalents of an oxide of nitrogen.

Now, this carbazotic acid can be prepared in large quantity from creosote by the action of nitric acid, and can be employed at once for dyeing. If I take a skein of silk and agitate it for a little in this carbazotic acid, it will take on the dye without any previous preparation, and it is dyed a beautiful yellow colour. You see how it has already taken on the colour, and in this way you can dye silks of a beautiful colour with this substance obtained from the former waste product of coal-tar. This material has also been lately employed, as almost everything is employed, for various other useful purposes. It is an excellent antiperiodic, like quinine, only when employed, it dyes the skin of the patients yellow, and they, therefore, have a sort of artificial jaundice. But it has also been suggested for another purpose. It may be mixed with arsenic and other poisons for the purpose of rendering them more ready of detection. It imparts to the arsenic a bitter taste, and it also turns the person to whom it is administered yellow, and in a case of slow poisoning this yellow appearance would be an indication that there was something wrong.

Cressylic acid, another of the compounds of crude coal oil, is not much employed in its separate state.

I now pass to the neutral hydrocarbons. The neutral hydrocarbons are also various. They are called benzol, toluol, xylol, cumol, cymol, and a great many other names with which I will not trouble you. They are compounds of hydrogen and carbon, and possess many degrees of volatility. For instance, benzol boils at 177°. This is one of the most useful of the substances. It is made from crude naphtha by a simple operation, taking advantage of its low temperature of ebullition. Here is a benzol still. The crude naphtha is placed in this still. It is a double still, into which steam is sent from this steam-boiler in order to heat the crude naphtha. The top of the still, you will observe, passes through a cistern of water. That cistern of water is kept at the boiling point of benzol, 177°, and the vapour of the naphtha passes through the heated vessel, which is heated to 177°. Benzol distils over at 177°; but toluol, cumol, cymol, and the others boil at a much higher temperature. Therefore they are condensed at that temperature, and fall back into the still. The separation is, therefore, effected simply by means of keeping the benzol at its own boiling temperature, and cooling the others below theirs. It is a very volatile substance. It, no doubt, adds much to the illumination of our coal gas. We will show you this. I have here the means of showing you the gas, first, not passed through benzol, and then passed through benzol. I first take the gas not passed through benzol, and if I light it you see that there is little illumination. You can scarcely see it at all at a distance. Now, I will pass some gas through this benzol. It is now passing through, and you see how the gas has licked up this volatile body, and given us a stronger illumination. Benzol is, no doubt, one of the illuminating vapours which exist in common coal gas.

Now, this body, when acted upon by nitric acid, produces what you will find in that big bottle—nitro-benzol. I must call your attention to nitro-benzol a little scientifically. Benzol has the forula $C_{12}H_6$,—that is, it contains twelve equivalents of carbon and six of hydrogen. In nitro-benzol one of these equivalents of hydrogen goes out, and one equivalent of oxide of nitrogen, NO_4, goes in and substitutes it, and then forms nitro-benzol, a substance which by itself possesses some peculiar characters. It smells strongly of bitter almonds, and it is employed now instead of bitter almonds. which is poisonous, for making common almond soap. That common almond soap which we buy is now perfumed with this nitro-benzol. It is also employed in confectionery as a substitute for bitter almonds. It is much better for that purpose, because the bitter almonds contain prussic acid, and by the use of too large a quantity by our cooks, we may poison our friends. There is no chance of that taking place when nitro-benzol is used. It is the basis from which we derive our tar colours, and the mode in which it is used for this purpose will require a little close attention to a chemical formula; but it is very interesting.

If nitro-benzol is acted upon by water and by iron, of which I have put down the symbols here—nitro-benzol + water + iron $= C_{12}H_5\,(NO_4) + 2\,HO + 4\,Fe$—the iron takes away all the oxygen from the water, and the oxygen from the oxide of nitrogen. There are six equivalents of oxygen, which the iron takes to itself and forms iron rust with it. This rust remains, and the two of hydrogen of the water now joins itself to the $C_{12}H_5N$, and produces this body here, $C_{12}H_7N$, aniline. That is to say, the iron takes away the oxygen and leaves oxide of iron and aniline as the result.

Now, this aniline is a most important body. It was first investigated by Dr. Hofmann, who has made with regard to it, a series of the most brilliant researches, out of which have arisen these coal-tar colours with which we are now acquainted. Aniline is an ammonia. It is a body exactly resembling the base ammonia, but it is what is termed a compound ammonia. Here is the constitution of ammonia:—

$$N\begin{cases} H \\ H \\ H \end{cases}$$

I put down the three atoms of hydrogen separately. Now, if I take away one of these atoms of hydrogen, and substitute it by one of something else which plays the part of hydrogen, I form a compound ammonia. I will do so in this case.

$$N\begin{cases} C_{12}H_5 \\ H \\ H \end{cases}$$

I have replaced one atom of hydrogen with a compound radicle which chemists call phenyle, and I obtain what is termed aniline. This aniline is therefore a compound ammonia in which the radicle phenyle replaces one of hydrogen.

When Hofman began his researches upon this subject, aniline was made by a laborious process

by distilling indigo with potash; and the possession of a pound of aniline in any chemical laboratory would have been looked upon as a wonder. Now you see that out of coal-tar we can present to you upon the lecture-table whole gallons of aniline, and it is now sold for a few shillings a pound. I have here a series of the substances formed in the production of Magenta. I am indebted for them to the discoverer of Rosaniline. Here is a block of coal weighing 100 lbs. This block of coal produces this amount of tar when distilled. Here is the amount of aniline which, with the most economical manufacture, can be extracted from that block of coal; but still, although it appears to you only a small quantity, it is, in fact, a most economical quantity compared with the processes which were formerly employed. It is out of this aniline that the peculiar dyes are obtained, and this is the quantity of the Magenta dye which can be obtained from that large quantity of coal. If you will examine these products after the lecture, you will find this a very instructive proportional series.

Now, it is out of this aniline that we produce mauve, Magenta, roseine, azuline, bleu de Paris, and the various colors which have received arbitrary names. It was known for a long time that the products of distillation of coal had a strong tinctorial power. Here, for instance, I have one of them—a body called pyrrole. I have here a piece of pine-wood, which I see Mr. McIvor has made, for a theatrical purpose, in the shape of a dagger. I will now moisten this with muriatic acid, and then place in a deep vessel which contains a few drops of pyrrole. You see that it suddenly gets as it were covered with blood. This muriatic acid is mixing with it, and the dagger comes out in a sanguineous state. You observe the strong tinctorial power which this substance has by the deep colour which it produces. Now this tinctorial power has been known, in fact, for a long time, but the mode of manufacturing the substance readily and economically was not known. Here I have a small quantity of aniline, and I agitate it with water; and now, if I add to that a solution of bleaching powder, you will see the effect it produces. It was long known that this aniline gave a purple colour with bleaching powder. The colour comes after a little while; it does not come immediately, but you see, as I add it, that the aniline produces a mauve or a purple colour; and this was known for many years, before persons knew how to make it for commercial purposes. This is now a colour used in the arts. The first person who introduced this, and to whom the greatest credit is due for its production, was Mr. Perkin, a pupil of Dr. Hofman. Mr. Perkin had seen and admired the tinctorial power of aniline, and he had an ambition to render this fugitive colour permanent, and to introduce it into the arts as a dye, and he succeeded admirably. The mode is this: this aniline is a base, and unites with sulphuric acid as ammonia does, and it forms sulphate of aniline. He takes equivalent quantities of aniline and bichromate of potash, and mixes them together, and in a little while, after standing together, they form this very unpromising-looking black powder. You see this black powder here; it looks extremely unlike a dye. Now, when this colour is washed with coal naphtha, this nasty-looking brown resinous substance is dissolved out of it by the coal naphtha, and then there remains a still unpromising substance, but which is rather purple in colour. When you treat with alcohol this brown powder, which has been washed with naphtha and had the resin taken out of it, it forms with the spirit a strong solution of mauve. This beautiful purple colour is obtained in this way,—by dissolving out of the brown powder the purple colour by means of alcohol; and it is this purple colour which is used largely in dyeing. It is readily soluble in alcohol. If I take a washing-bottle of alcohol, and throw a little of it upon the substance, you see that the beautiful purple colour of this substance is readily manifested. (The substance had been previously spread on a white paper screen, and there remained unapparent; but upon the projection of the stream of alcohol upon the screen, the purple colour was produced where the alcohol came in contact.) It is a substance which you can easily detect and find out whether you are dealing with this colour, or dealing with some colours derived from lichens, which have a similar character. I have here aniline purple, and I now add to it a little sulphuric acid, and I will show you that it is very easy to detect which colour you are dealing with. The sulphuric acid turns it first to a dirty green. If now I add to this a little water, this dirty green becomes a beautiful blue. The light has become bad. The day is not a good one for showing you these colours. I am afraid this day-light, or want of day-light, will render it necessary for you take what I say on trust. The addition of water makes it a beautiful blue. This is a second test for it; but if now I add a little more water to it, it is restored again to its purple state. You see on pouring it into this large jar that it resumes its beautiful purple, and in this way you can easily detect its presence. The sulphuric acid turns it a green, a little water turns it a deep blue, and a large quantity of water brings it back to its original purple condition.

It is easy to dye with this aniline purple; in fact, ladies can dye with it perfectly themselves. It is only necessary to use for this purpose hot water—water so hot that you cannot bear it with your hand, but not boiling. The best temperature is about 150°. If you take this hot water and add to it a little tartaric acid and a little of this aniline purple, and then place the silk or woollen in it, it becomes dyed. It is easy to attach the colour to animal fibre, but not to cotton. In the next lecture I have to explain to you its application with regard to cotton. I have here the colouring matter, and now I will add to it a solution of tartaric acid, which is necessary to produce the colour. After that all I require is to place my silk in this solution, and to rinse it for a little time in it, and you see that it quickly takes up the colour and produces that beautiful mauve which is now so familiarly known. It is, therefore, a substance which is extremely easily applied—almost as easily as the carbazotic acid.

Although I am within a minute of the hour, I must ask your attention for five minutes more. The next dye to which I have to direct your attention is Magenta; or, as it is more properly called by Dr. Hofman when it is in the state of purity, rosaniline. I should like also to prepare this before

you, and show you the method. Any weak oxidising agent less strong than bichromate of potash, produces this substance. I will take here bichloride of tin for my purpose. I add to this anhydrous bichloride of tin an excess of aniline. It must be done cautiously, for the action is energetic. As soon as the action subsides we will add a little more, and finally heat it until I drive off all the aniline. I must have an excess of aniline and then drive it off, after which the Magenta will be seen to appear. This will take a little time to perform. Mr. McIvor will now heat this gently, passing it slowly over the flame at first, as the action is violent, and will continue the heat until our Magenta begins to appear. After a little time we shall have a very good imitation of Magenta, but not nearly so good as is produced by the manufacturers, who now produce it on the most magnificent scale; I allude to Messrs. Simpson, Maule and Nicholson. to whom I am indebted for a number of the illustrations that are exhibited here, and for this crown, which is made of the substance in the ordinary condition in which it is sold—acetate of rosaniline. You see what a magnificent crown it is. The formula of rosaniline I have written here.

$$N_3C_{40}H_9$$

It is what is called a triamine, or it is three atoms of ammonia which have coalesced into one; and this rosaniline forms, with acetic acid and other acids, deeply-coloured salts, of which this ordinary Magenta is one. You will see a crown in the Exhibition, which I think is one of the most remarkable of the scientific exhibits which we possess, The crown is composed of the acetate of rosaniline. You see the difference between this rosaniline and mauve. It is of a much redder colour than mauve, and is more definite in its character. Mauve is a neutral body, not possessing either basic or acid properties; while, on the other hand, rosaniline is a true ammonia—a true base.

Now we have formed our Magenta by this experiment. I think I can show you the colour better if I pour it into water and add an acid. You will then also see its tinctorial power. After a little time it will dissolve and form a solution of this substance. It is a powerful tinctorial body. There (referring to a bale on the lecture table) is the quantity of woollen which is dyed from the amount of Magenta produced from 100lbs. of coal. There is the 100lbs. of coal which produces this small quantity of Magenta and that bulk of wool is dyed from it, so that you see its tinctorial power is great.

As I have only given you an introduction to the subject, and you will afterwards have the application of this to calico printing I will only say one word as to the blue colour which is obtained, and in the next lecture, and the lecture afterwards, we shall have an abundant opportunity of following up this subject. Not only have reds and purples been obtained in this way, but a yellow has recently been procured by Mr. Nicholson, to whom we are so much indebted; so that yellow, red and blue, the three primitive colours, are now to be obtained from the coal-tar. Here is one called *bleu de Paris*, or *bleu de Lyons*, or azuline. It is obtained sometimes from aniline by the action of oxidising agents, such as bichloride of tin, at a high temperature under pressure—a temperature of 350°. But most of these blue colours are made from carbolic acid, and not from aniline. I think I can show you here the blue colour. I have put some of this blue upon this paper. There is one which is obtained from carbolic acid or from creosote. The process, however, is not known; it is still kept a secret in the arts, but you see what a beautiful colour it is; and what a power we have in possessing the three primitive colours, by the mixture of which we can obtain so many others.

As a new art, the manufacture of these colours is of great importance. Hitherto, England has been dependent upon foreign countries for its dyes. We have imported madder from Holland, from Turkey, and from France, and blue colours from India, in order to produce our calico prints; but you see now that we are likely to reverse this. We find in this waste product, coal-tar, the three primitive colours out of the mixture of which we can produce almost any shade we desire; and without taking upon myself the character of a prophet, I think I may easily predict that, in a few years, England will be a colour-exporting instead of an importing country. In this country, even now, coal-tar, notwithstanding all these applications of it, is worth only from a penny to three halfpence a gallon. These discoveries will probably alter the whole character of calico printing, and make this country an export market of colours.

As this is a highly important industry, I have solicited your attention to two other lectures on it.

Miscellaneous.

THE CAPE RACE TELEGRAPH.

The general form of Newfoundland is that of an irregular triangle, having the south coast at its base. At the south-eastern extremity is Cape Race (from the Portuguese, Cap El Raz, the "Captain's Cape"), which all the steamers running from England to New York, Boston, or Portland endeavour to make, as it lies directly in their route, or rather in their way,—as a detour has to be made from the direct line in order to clear it. The coast at Cape Race is bold and rocky; the cliffs rise in precipices out of the water and their strata are tossed and torn asunder, as if by some great convulsion of nature.

On the top of the cliffs, a very short distance from the edge, stands a well built lighthouse, painted red with white vertical stripes. A little further inland is the telegraph station, a small, neat building, from which the wires can be seen stretching away on tall poles, standing out clearly on the moors and barrens which are the great features of Newfoundland.

Two whale boats, of very best description, are employed to board the steamers which pass. Both these boats were built at New York; one is a "Whitehall" boat, and the other, said to be the best of the two, was built in Brooklyn. These boats are kept in recesses of the rocks, one on each side of the Cape, so as to take advantage of that side which may be at the moment the most favourable for launching or landing—both operations being attended with considerable danger. The crew consists of four oarsmen, natives of Newfoundland,

and magnificent men they are, equal to any and every emergency, The fifth man is their steersman—Mr. Murphy, the news agent. He is said to be a native of Sydney, Cape Breton, and certainly the way in which he manages a boat in all weathers and makes his way on board vessels at times when the most daring would tremble, is something quite wonderful and scarcely to be credited. To see him standing up with a foot on each gunwale, swaying with the motion of the boat in the most awful sea, and steadying himself with the tiller ropes, ready for his spring, in boarding, is enough to make the blood run cold while watching him.

In the night, or in unusually stormy weather, when the boat cannot overtake or get near the steamer, a tin cannister is thrown over, containing the latest newspapers and despatches. These canisters are cylindrical, about 18 inches in length and six in diameter; they are carefully soldered up, and have a piece of lead at one end to make them float upright in the water, while straps at the side carry a slight pine staff, about three feet long, bearing a tiny flag, which serves to mark the position of the canister, and render it more easily seen and picked up. Having obtained the news the men pull for the shore with long and powerful stroke and the boat goes dancing over the waves in right gallant style. Murphy springs ashore at any available point; he is next seen scrambling up the clifts and rushing along to the station house with the speed of a reindeer, for he is active on land as on sea. From thence the news is sent off without an instant's delay by wires which stretch from that point 400 miles westwardly to Port au Basque, over one of the wildest countries in the world—mountains, moors, ravines, roaring torrents, and mad precipices following each other in quick succession.

Port au Basque is at the south-western extremity of Newfoundland, near Cape Ray—a name also derived from the Portuguese—*Cap el Rey*, the "King's Cape." From this point a cable is submerged across the main entrance to the Gulf of St. Lawrence, here 57 miles wide, to Aspy Bay, at the north-eastern extremity of Cape Breton, between North Cape and Smoky Cape, both remarkable headlands rising directly from the sea to the height of 1,300 feet and 950 respectively.

From Aspy Bay, the line is brought through the broken but most picturesque country which forms the interior of Cape Breton, to the northward of a magnificent sea-lake known as the Great Bras d'Or, and passes on to its western extremity at the peninsula of St Peter's. Thence it follows the post road to Plaister Cove, in the Strait of Canso, where communication is maintained with the shore of Nova Scotia (the mainland of America) by means of a submarine cable not much more than half-a-mile in length. This is landed in a cove a little to the northward of Cape Porcupine, which cape is nearly a thousand feet in height.

Thence the cape Race line follows the eastern coast of Nova Scotia, by Antigonish, to Merigomishe (around the head of Pictou Basin) on to Port Wallace and Pugwash, whence it strikes off to Amherst, and there intersects the main telegraph with the whole western world, terminating only in the Pacific.

BRUNEL'S MISHAPS.

Although Brunel died at the comparatively early age of fifty-three, it is even matter of surprise that he lived so long, He had more perilous escapes from violent death than fall to the lot of most men. We have seen that at the outset of his career when acting as assistant-engineer to his father in the Thames Tunnel, he had two narrow escapes from drowning by the river suddenly bursting in upon the works. Some time after when inspecting the shafts of the railway tunnel under Box Hill, he was one day riding a shaggy pony at a rapid pace down the hill, when the animal stumbled and fell, pitching the engineer upon his head with great violence: he was taken up for dead but eventually recovered. When the Great Western line was finished and at work he used frequently to ride upon the engine with the driver, and occasionlly he drove it himself. One day, when passing through the Box Tunnel upon the engine at considerable speed, Brunel thought he discerned between him and the light some object standing on the same line of road along which his engine was travelling. He instantly turned on the full steam and dashed at the object, which was driven into a thousand pieces. It afterwards turned out to be a contracter's truck which had broken loose from a ballast-train on its way through the tunnel. Another narrow escape which he had was on board the Great Western steam-ship, where he fell down a hatchway into the hold, and was nearly killed. But the most extraordinary accident which befel him was that which occurred while one day playing with his children. Like his father Sir. Marc, he was fond of astonishing them with sleight-of-hand tricks, in which he displayed considerable dexterity; and the feat which he proposed to them on this occasion was the passing of a half-sovereign through his mouth out of his ear. Unfortunately he swallowed the coin which dropped into his windpipe. The accident occurred on the 3rd of April 1843, and it was followed by frequent fits of coughing, and occasional uneasiness ln the right side of the chest; but so slight was the disturbance of breathing that it was for some time doubted whether the coin had really fallen into the windpipe. After the lapse of fifteen days, Sir B Brodie met Mr. Key in consultation, and they concurred in the opinion that most probably the half sovereign was lodged at the bottom of the right bronchus. The day after, Mr. Brunel placed himself in a prone position on his face upon some chairs, and bending his head and neck downwards, he distinctly felt the coin drop towards the glottis. A violent cough ensued and on resuming the erect posture he felt as if the object again moved downward into the chest. Here was an engineering difficulty, the like of which Mr. Brunel had never before encountered. The mischief was purely mechanical; a foreign body had gone into his breathing apparatus, and must be removed, if at all, by some mechanical expedient. Mr. Brunel was, however, equal to the occasion. He had an apparatus constructed, consisting of a platform which moved upon a hinge in the centre. Upon this he had himself strapped, and his body was then inverted in order that the coin might drop downwards by its own weight, and so be expelled. At the first experiment the coin again slipped towards the glottis, but it caused such an alarming

fit of convulsive coughing and appearance of choking that danger was apprehended, and the experiment was discontinued. Two days after, on the 25th, the operation of tracheotomy was performed by Sir Benjamin Brodie, assisted by Mr. Key, with the intention of extracting the coin by the forceps, if possible. Two attemps to do so were made without success. The introduction of the forceps into the windpipe on the second occasion was attended with so excessive a degree of irritation, that it was felt the experiment could not be continued without imminent danger to life. The incision in the windpipe was, however, kept open, by means of a quil or tube, until May 13, by which time Mr. Brunel's strength had sufficiently recovered to enable the original experiment to be repeated. He was again strapped to his apparatus; his back was struck gently; and he distinctly felt the coin quit its place on the right side of his chest. The opening in his windpipe allowed him to breathe while the throat was stopped by the coin, and it thus had the effect of preventing the spasmodic action of the glottis. After a few coughs the coin dropped into his mouth. Mr Brunel used afterwards to say that the moment when he heard the gold piece strike against his upper front teeth, was, perhaps, the most exquisite in his whole life. The half-sovereign had been in his windpipe for not less than six weeks!—" *The Brunels,* " *in the Quarterly Review.*

SIR W. E. LOGAN AND CANADIAN MINERALS AT THE EXHIBITION.

Canada is most worthily represented in Class I., thanks to the director of the Canadian Geological Survey, Sir William Logan. Justice compels us to deviate from the course which we have hitherto pursued, and bestow more than a passing notice on this indefatigable geologist. Unaided he commenced in 1831, a geological survey of part of the great South Welsh coalfield, extending from Owm Avon to Carmarthen Bay, and completed it in seven years, at no small pecuniary sacrifice. Such was the estimate of the accuracy and value of this survey by the director of the Geological Survey of Great Britain, Sir Henry De La Beche, that, with Sir William Logan's consent, it was adopted as a part of the national work. In 1842, Sir William went to Canada, where he has ever since resided, devoting his life with a singleness and earnestness of purpose truly remarkable to the exploration of the structure and the mineral resources of that vast territory. Not having the advantage of an accurate map of the country, such as has been supplied to our home geologists by the Ordinance Survey, he has been obliged to make a topographical survey *pari passu* with a geological one. Few persons can imagine the arduous nature of this work. Our indomitable geologist is often compelled to penetrate the trackless primeval forest, to force his way across the tangled cedar swamp, and brave the dangers of Canadian rapids in a frail canoe; and to these difficulties we may add that his passage is obstructed at every step by the most relentless and invincible foes with which man in these regions has to contend—countless hosts of mosquitoes and black flies. Very different is the comparatively light and gentlemanlike occupation of our home geologists, who have no such hardships to encounter, and, after the pleasant ramble of the day, never fail to enjoy the luxury of an English cottage. Sir William Logan has neither sought wealth nor honors, but has quietly and honestly pursued the one great object of his life with a devotion as rare as it is praiseworthy. Let it not be supposed that this eulogium is prompted by any feeling of personal regard. It is a just tribute, and no more, to a man who has striven during many years to develope the vast mineral resources of Canada, not with a view to his own advancement, but from pure love of his work. We are glad to know that the Canadian Government fully appreciate the value of the labours of this self-denying and faithful public servant. The Canadian territory comprises about 300,000 square miles, and about 100,000 have already been surveyed by Sir William and his small staff of assistants.—*London Times.*

PETROLEUM—EXPERIMENT TO DETERMINE ITS COMPARATIVE ILLUMINATING POWER WITH GAS AND CANDLES.

It is not the difference in price per gallon between two burning fluids, or other agents employed in artificial illumination, that determines their respective cost for use. One burning fluid, such as a mixture of alcohol and turpentine, that costs only sixty cents per gallon, may be more expensive than sperm oil costing one dollar and a quarter; because the latter possesses three times the illuminating power of the former. It is well known that refined petroleum has lately driven all other burning fluids out of use, and one reason for this is its very low price. But as we have already stated this cannot determine its economy—its comparative illuminating power must also be known to form a just estimate of its cost. Heretofore this has been unknown, but now we have a most valuable contribution to science in the record of a series of experiments conducted by Professor James C. Booth and Mr. T. H. Garrett, of Philadelphia, and published in a late number of the Journal of the Franklin Institute. Their experiments were chiefly instituted to test the comparative illuminating power of petroleum and the common coal gas used in Philadelphia. The gas was measured by a water meter, and the jet used was a fishtail burner attached to the top of the meter, and fixed at the uniform distance of six feet from the photometer. The lamp for burning the fluid and giving equal light to the gas jet, was measured on the opposite side of the photometer. Messrs. Booth and Garrett first determined by experiment the relative economy of several coal and mineral oils, and common burning fluid (alcohol and turpentine). Of four kinds of mineral oils, or refined petroleum there was but little difference in their illuminating power. It was found that 2.599 gallons gave a light equal to 1,000 cubic feet of gas, and it required no less than 11.699 gallons of burning fluid to produce an equal amount of light; thus proving that one gallon of petroleum is equal to four of burning fluid for giving light. Various experiments were also made with flames of different shape in the petroleum lamp, to determine which form gave the most intense light with the least quantity of oil. It was found that a clear, straight cut of the wick gave the best results. The most

common way of trimming such lamp wicks is with an arched cut, to produce a flame shaped like a bow. With a flame from a wick cut straight across, 2.576 gallons of oil gave a light equal to 1,000 cubic feet of gas, while with an arched flame, 2,846 gallons of oil were required. Very great care must be observed in trimming the wicks of oil lamps, so as not to leave them ragged at the edges. A loss varying from four to twenty per cent. was observed with different trimmed wicks. Messrs. Booth and Garrett say on this head, "The best method of obtaining the fullest amount of light, is to trim the wick straight across, and test the shape of the flame until it presents as even a top as practicable."

Experiments were also made to determine the relative illuminating power of gas and paraffine, and spermaceti and adamantine candles. It was found that it required 35.53 pounds of paraffine candles to produce a light equal to 1,000 cubic feet of gas; 41.16 pounds of spermaceti, and 47.18 of adamantine. A very great loss of light results from permitting beads of smoke to accumulate on the ends of candle wicks. The relative cost to produce an equal amount of light, is also given in the paper of Messrs Booth and Garrett. For 1,000 cubic feet of gas, the price in Philadelphia is $2 10; for 2$\frac{4}{8}$ gallons of refined petroleum (at 45 cents per gallon) $1 07; for spermaceti candles, $18 50; for paraffine candles, $11 68; for adamantine candles $11 72. There can be no question, therefore, judging from these experiments and statistics, that petroleum is the cheapest known agent of artificial light. Against its common use, however, it may be said that it is dangerous, being liable to explode. It is not, indeed, so dangerous as alcoholic burning fluids; still it is dangerous when by improper distillation, or the cupidity of the manufacturer, the light, volatile fluid called benzine is permitted to remain in the oil. All petroleum lamps should be filled during day, and the oil should be kept in a cool place. The following advice is given to gas companies:—

"We leave it to gas companies to resolve this question, or its alternative—whether the extraordinary comparative cheapness of mineral oil illumination will not stimulate invention to contrive ways of burning the oil, or of making gas from it in a small way, so as to obviate every objection to its use and so supersede the use of company made (coal) gas."—*Scientific American.*

MR. GLADSTONE ON ENGINEERS.

At the inauguration of the statue to Sir Hugh Myddelton, Mr. Gladstone concluded an eloquent address with the following observations upon engineers:—"It is a thing somewhat new in the history of mankind to erect in public places the statues of engineers. If we go back to the very first roots and beginnings of philosophy, we shall find that whatever related to mechanics and to physical force was associated with strictly and purely mental inquiries; but they soon came to be divorced one from another, and thousands of years elapsed before the engineer, as such, came to be recognised as a person having a high title to public distinction. It does not appear that the people of this country in very early times had developed much of the talent for which they are now so remarkable, and thus we see, in reviewing the history of the nation to which we belong, that at the later period of its career it has exhibited aptitudes of which there was no trace at an earlier period. Let me say, in passing, that that is a useful lesson, not for nations only but for individuals, for it may teach an individual that there are many things at present wholly beyond his power, and for which he cannot even recognise in himself materials and fitness, and yet to which he may thoroughly and conspicuously attain by assiduous and resolute cultivation of the faculties which God has given him. No doubt the engineers who, under the name of architects, erected the cathedrals of this country, must have been persons considerable in their profession; but for much of their education we are indebted to foreign countries. It was rather in the main an imported than an indigenous quality; but in these later times we have seen a great change, and the engineers of this country have taken their place as one of the most important and most distinguished classes of the community. They have fairly taken their place amongst the great men of England; and I do not know whether any commemoration has yet been given to any of them so conspicious as the erection of this statue of Sir Hugh Myddelton in one of the greatest thoroughfares of this vast metropolis. It is a fact full of meaning; it is an indication of the movements of the times, and the development of those faculties by which man is fitting himself more and more by the efforts of each generation in succession to contend with those difficulties of outward nature amidst which Providence has placed him for the purpose of evoking his energies, and to make the gifts and bounties of Providence available for his comfort and his happiness. This is the opening almost of a new chapter in the condition of man. I do not mean that it is the beginning of such efforts, but it is the beginning of them on a new scale, with a new system, with new appliances, and with new means for the intercommunication and interchange of knowledge; and it marks the fact that in the list of elements that belong to human civilisation these great operations of art and science, applied to the external world, must henceforward be included, and hold a conspicuous place; and it will be our own fault if the addition of that new chapter fail to be a great blessing. There is no reason why it should displace anything; and therefore let us not see in the distinctions bestowed upon the engineers anything that need fill us with fear or apprehension; and do not let us see in it the displacement of whatever has been done by man with respect to religion, art, or ancient learning. All these things ought to continue to grow and thrive, and that which we introduce we ought to add to what we have enjoyed before, and not substitute for what we have been enjoying. it is an immense blessing—it is a work of which we may confidently say that it is acceptable to God as well as to man—when water is brought from a distant spot to supply the population of this great city. It is all very well for most of us who are assembled here to make light of these great appliances of modern engineering, and to think that it does not signify whether we are carried fifty miles an hour or five—whether our houses are well drained or not, and whether the water of the country is brought to feed London. It is all very well for us to assume a

high and sanctimonious tone and say, 'Do not let us overwhelm these temporal goods and comforts.' It is wise that the poor should be remembered; and I have no doubt that the ministers of religion will take care to remind them that they are not to suffer their minds to be absorbed and dried up with the continual contemplation of temporal and physical necessities, but ever to lift their eyes up to the God that is in heaven; but language such as that need not be held amongst the wealthy. Let us freely and gratefully acknowledge that those who, like Sir Hugh Myddelton in former days, devote themselves with energy, forethought, care, and skill to the multiplication of appliances which conduce to the comfort of man, and to conquering the forces of nature and making them subservient to human happiness, are doing a great and good work before the face of Heaven as well as before the face of man, and deserve to be held in grateful honour as real and genuine benefactors of mankind."

Electric Clock.

This is an invention by Mr. C. G. Gumpel, M. E. By this plan the oscillations of the pendulum are independent and free of any influence from the motive power (whether electricity or gravity). The pendulum is compensated. The rod, good white deal, is baked, and soaked in a mixture of bees-wax, oil of turpentine and linseed oil, and then French polished to prevent absorbtion of moisture. The compensation consists of a zinc tube (sheet zinc) resting on the adjusting nut at the bottom of the wing rod; on the top of the zinc tube rests the cast iron bob by means of a plate screwed on the latter. The proportions are the following:—

Co-efficient of Expansion.

White deal	23
Cast iron	66
Zinc	170

Length in inches.

Cast iron bob and also zinc tube.................. 7·17

Wood rod.......................... $39{\cdot}14+\frac{7{\cdot}17}{2}=42{\cdot}72$

Expansion Upwards.

Of zinc tube.................... $7{\cdot}17 + 170 = 1218{\cdot}90$

Expansion Downwards.

$$\left.\begin{array}{ll}\text{Of wood rod} \ldots & 23 + 42{\cdot}72 \\ \text{Of cast iron} \ldots & 66 + \frac{7.17}{2}\end{array}\right\} = 1218.84$$

The pendulum is suspended by means of an agate (with the grove inverted) on a cast steel edge (slightly rounded). By this arrangement the dust cannot accumulate to destroy the surface, while the rounded edge produces a rolling motion, preventing the sharp edge of the steel wearing into the stone. (The pendulum by itself oscillated 1¼ degree at a quarter to eleven o'clock one evening, which had subsided about seven the following morning morning [after eight hours] to one fourth degree.) The weight of the pendulum bob, with zinc tube, is about twenty-one pounds. The pendulum in this clock has nothing to do but to disengage the slight arms, from which it receives the required impulse. These arms descend only about one fiftieth part of an inch more than they are uplifted, and yet maintain an oscillation of the pendulum of 2½ degrees. The acting weight suspended from the curved lever, for the purpose of uplifting the impulse arms, is 2½ drachms, exerting a pulling pressure (longitudinally) of about 1½ drachms at the point, where the arms hold the curved lever, so that the actual force required to disengage the arms is a high fraction of a drachm (the hooks of the curved lever and the pin in the impulse arms being hardened and polished cast steel.) Hence the pendulum insures a correct time keeper, equal (by even inferior workmanship) to the best astronomical clock. In the best known electric clock, the pendulum makes a contact at each oscillation by bending a spring, which, in itself, as the temperature varies, will influence the rate of the clock. Besides the manner in which the impulse is imparted to the pendulum in that clock is not free from friction, and tends to produce "wobbling," as the impulse, although parallel, is not in the same plane as that in which the pendulum oscillates. The contact makers are formed of iron cups, containing mercury, into which dip pieces of copper with iron ends. The one enters the mercury before the other leaves, so that no spark from the direct current can oxide the surfaces of the contact makers, as both transmit the same current alternately; the left one to the magnet of the pendulum, the right one to the clock. In the clock a separate contact is made every minute, which will keep any number of filial clocks going, all showing the same (that is, correct) time. The minute wheel shows (in the clock exhibited) a method of moving the hands of large clocks by means of two pins (placed diametrically) gearing into an ordinary wheel. It is impossible to shift the hand; and if held it will always, within the minute, place itself right. The clock is intended for large mansions, palaces, hotels, club-houses, warehouses, hospitals, &c. The pendulum in an airtight case being fixed on the basement floor on a good foundation, while the battery is placed at any convenient spot easily accessable. The inventor claims the application of the same escapement to clocks moved by gravity, in which it is stated it will, undoubtedly, show its superiority over other escapements for the purpose for which a clock is intended—correct time keeping.—*Artizan.*

Illuminating Oil from Coal.

Appears to have been made as early as 1846 by Dr. Gesner, of Nova Scotia, and in 1854 the Kerosene Oil Company, on Long Island, commenced the first manufacture of carbo-hydrogen oil under patents secured by Dr. Gesner, using cannel oil from England, New York, and other parts of the United States. The Breckinridge coal oil works on the Ohio, at Cloversport, Kentucky, were commenced in 1856, and were soon followed by others, to the number of twenty-five in operation in 1860 in Ohio alone with a working capacity of three hundred gallons of light oil each, per diem. There were then about fifty-six factories in the United States, exclusive of some fifteen engaged altogether on petroleum, and several small private coal oil works. The capital expended in coal oil works and cannel coal mines was estimated at nearly four million dollars. The manufacture of coal-oil lamps, resulting from the use of the oil, formed the principal business of sixteen companies, who employed 2,150 men and 400 women and boys, and work for 125 looms in making the lamp wick.

The Production of Petroleum in the United States.

Its existence in any vast amount appears to have been unknown until 1845, when a spring was "struck," while boring for salt, near Tarentum, thirty-five miles above Pittsburgh, on the Alleghany. Experiments having proved its constituents to be nearly the same as those of the artificial carbon oil, a company was organized in New York to attempt its purification by the same process applied to the latter. But little was effected, however, and in 1857 Messrs. Bowditch & Drake, of New Haven, commenced operations at Titusville on Oil Creek, where traces of early explorations were found, and in August, 1859, a fountain was reached by boring, at a depth of seventy-one feet, which yielded four hundred gallons daily. Before the close of the year 1860, the number of wells and borings was estimated to be about two thousand, of which seventy-four of the larger ones were producing daily, by the aid of pumps, an aggregate of eleven hundred and sixty-five barrels of crude oil, worth, at twenty cents a gallon, about ten thousand dollars. Wells were soon after sunk to the depth of five or six hundred feet, and the flow of petroleum became so profuse that no less than three thousand barrels were obtained in a day from a single well, the less productive ones yielding from fifteen to twenty barrels per diem. In several instances extraordinary means were found necessary to check and control the flow, which is now regulated in such wells, according to the state of the market, by strong tubing and stop cocks. The quantity sent to market by the Sunbury and Erie Railroad from the Pennsylvania oil region, which has thus far been the principal source, increased from 325 barrels in 1859 to 134,927 barrels in 1861. The whole quantity shipped in the last-mentioned year was nearly 500,000 barrels. Since August, 1861, the product has rapidly increased. The present capacity of the wells is estimated at 250,000, to 300,000 barrels per week. So important, however, have the operations in this article become, that a railroad, we understand, has been chartered in Pennsylvania exclusively for the transportation of the oil to market. From a recent number of the *Registrar*, a newspaper published in Titusville, Pennsylvania, we copy the following statement respecting the production of petroleum in that vicinity;—"We learn that the number of wells now flowing is seventy-five; the number of wells that formerly pumped and flowed is sixty-two; the number of wells sunk and commenced is 358; total, 495. The amount of oil shipped is set down at 1,000,000 barrels; amount on hand to date 94,450 barrels; present amount of daily flow, 5,717 barrels. The average value of the oil at $1 per barrel, is $1,092,000; average cost of wells, at $1,000 each, is $495,000; machinery, building, &c., from $500 to $700 each, $500,000. The total number of refiners is twenty-five. The detailed report of the condition of the wells shows that production is on the increase. Holders are firm at fifty cents per barrel at the wells, and don't seem to care about selling any great amount at that price." With increased facilities for getting it to the seaboard at a cheap rate for transportation, the operations will doubtless become much more extended than at present. The quantity exported from the cities of Philadelphia, New York, Boston, Baltimore and San Francisco, from the 1st of January to the 1st of April, 1862, amounted to 2,342,042 gallons, valued at $633,949. The receipts at Cincinnati, during the same period, of carbon and petroleum oils, were 519,960 gallons, or 13,000 barrels, nearly one-half of which was petroleum oil. The exports from the three cities first mentioned, from the 1st of January to the 16th of May of the present year, were 3,651,130 gallons, worth $889,886, and the shipments in the last week of that period from the same places were 255,600 gallons, valued at $42,160.

A large reduction has taken place in the price since the commencement of the trade, and particularly during the last few months. The price of crude petroleum in Philadelphia on the 4th of January, 1862, was from 22½ to 23 cents a gallon, and of refined oil 37½ to 45 cents. On the 29th of March the prices has declined at the same place to 10 and 12 cents for crude, and 25 to 32 cents for refined oil, while the most recent price current lists place it at 9 and 19 cents. Although the capacity of the existing wells already exceeds a profitable demand, there appears to be no assignable limit to the flow, or to the localities which may be found to yield it, whenever an augmented demand shall warrant farther search or increased production.

Coal Tar made Picturesque.

If coal be regarded as the product of ancient sun-force, then the "light of other days," which has not faded, may be reproduced in colour of every shade and hue. Every one knows that when coal is distilled gas is produced, is carried away and collected, and that among the refuse products of the process is coal tar, which was formerly sold at a very low price. Coal tar is a very complicated body, and, when carefully distilled, it yields certain volatile fluids, smelling more or less of tar, among which is a naptha called "benzole." Small bottles of benzole are sold for removing grease stains under the name of *benzine collas*. Benzole is next acted on by nitric acid, and by that means changed into nitro-benzole—a liquid having so exactly the smell of the essential oil of bitter almonds that it is substituted for it in the manufacture of almond soaps and of cheap perfumery. When iron filings and acetic acid act upon the nitric benzole it is changed into aniline, and this aniline when acted on by arsenic acid, bichromate of potassia, permanganic acid, stannic chloride, &c., yields a great variety of very beautiful colours. These coal-tar dyes are a characteristic feature of this Exhibition. In Perkin's case the visitor will see a cylinder of solid aniline purple, which could easily be carried under the arm. It is worth at least £800, and required for its production the tar obtained from 2,000 tons of coal. It is in tinctorial potentiality equal to 100 miles of calico. Thus are we reminded that death in nature is but new life. Force is, indeed, indestructible; form alone it is which changes. The actual elements caught up from the air millions of years ago, and then quickened into vegetable life by the sun that shone on earlier scenes than Eden, are now delighting the eye and gratifying the taste. The elements of the decayed forests of a pre-Adamite earth, are quickened in 1862, and re-assembling, show that "a thing of beauty is a joy for ever."

Mineral Resources of New Brunswick.

In the interesting pamphlet distributed in the New Brunswick department we find some valuable information with relation to the mineral resources of the province. The carboniferous system of rocks covers an area equal to more than one-third of the entire province. In such an extensive formation of this nature coal must abound; but until within the last few years very little of it was raised in New Brunswick; and, indeed, it was questioned by many whether it existed in sufficient quantities to pay for its working. A seam had been opened for several years at Grand Lake, one of the feeders of the St. John River, and about 900 tons of coal were taken from it in 1851; but this of course, was little better than nothing. Within a few years the discovery of a new species of coal, or mineral substance resembling coal, in Albert county, has directed much attention to that county, and one or two other seams of coal have been discovered. The coal of Albert is principally bituminous and cannel, and is of a superior description for the manufacture of coal oil, gas, &c. In 1859, 15,000 tons of the first-mentioned coal were taken out, and it sold at the mine for $15, or 3*l.* sterling, per ton. During the past year a vein of pure Cannel coal, 10 ft. wide, has been discovered in the same county, and preparations are being made to work it on an extensive scale. In the vicinity oil works have been erected for the manufacture of oil. The discoveries in Albert have been a source of much gratification to the people of the province, as evidencing that abundant supplies of coal do exist, and that the coal measures are not so barren as some have supposed. Indeed, it is likely that more critical examinations of other sections of the country will prove that localities where coal is now only supposed to exist in small quantities are rich in their deposits of this precious mineral. The value of the coal exported in 1858 was 13,743*l.*; in 1859 the exports were nearly three times as valuable. Iron ore abounds in New Brunswick. It has been found in considerable quantities near Woodstook (of the hematite species), and smelting-works on an extensive scale were at one time in operation there, very fine iron being produced. The bed of iron found near Woodstock is in three separate strata of respectively 28, 15, and 27 ft. Iron ore has also been found in considerable quantities on the Nerepis road, some distance below Fredericton. Its thickness is described as varying from 20 to 60 yards. One great reason why the iron of New Brunswick is not worked more extensively is accounted for by the fact that as coal has not yet been found in the vicinity of the ore, and the cost of its conveyance thither so increases the price of the melted iron as to prevent its finding a ready sale. This is an obstacle, however, that time will overcome. Gypsum, copper, lead, potter's clay, fire-clay, &c., are also found in large quantities.

Brilliant Whitewash.

Many have heard of the brilliant stucco whitewash on the east end of the President's house, at Washington. The following is a receipt for making it, as gleaned from the *National Intelligencer*, with some additional improvements learned by experiment:—

Take half a bushel of nice unslacked lime, slack it with boiling water, cover it during the process to keep in the steam, and add to it a peck of clean salt, previously well dissolved in warm water; three pounds of ground rice, boiled to a thin paste, and stirred in boiling hot; half a pound of clean glue, which has been previously dissolved by first soaking it well, and then hanging it over a slow fire in a small kettle with a large one filled with water. Add five gallons of hot water to the whole mixture; stir it well and let it stand a few days covered from the dirt. It should be put on right hot; for this purpose it can be kept in a kettle on a portable furnace. It is said that about one pint of this mixture will cover a square yard upon the outside of a house, if properly applied. Brushes more or less small may be used, according to the neatness of the job required. It answers as well as oil paint for wood, brick or stone, and is cheaper. It retains its brilliancy for many years. There is nothing of the kind that will compare with it, either for inside or outside walls. Coloring matter may be put in and made of any shade you like. Spanish brown stirred in will make red or pink more or less deep according to the quantity. A delicate tinge of this is very pretty for inside walls. Finely pulverized common clay, well mixed with Spanish brown before it is stirred into the mixture makes a lilac colour. Lampblack in moderate quantities makes a slate color, very suitable for the outside of buildings. Lampblack and Spanish brown mixed produce a reddish stone color. Yellow ochre stirred in makes a yellow wash—but chrome goes farther, and makes a colour generally esteemed prettier. In all these cases the darkness of the shade will of course be determined by the quantity of coloring used. It is difficult to make a rule, because tastes are very different; it would be best to try experiments on a shingle and let it dry. It is said that green must not be mixed with lime. The lime destroys the color, and the color has an effect on the whitewash which makes it crack and peel. When walls have been badly smoked, and you wish to have them a clean white, it is well to squeeze indigo plentifully through a bag into the water you use, before it is stirred into the whole mixture. If a larger quantity than five gallons is wanted, the same proportions should be observed.—*Scientific American.*

Preservation of Meats.

At a recent meeting of the Society for the Encouragement of National Industry, M. Peligot read the following note of M. Martin de Lignac on his new patented process for the preservation of meats:

"In the usual way of salting, the meat is placed first in salt, and afterwards in the pickle. The salt absorbs the liquids in proportion as they separate from the flesh, then the pickle penetrates by endosmose, and preserves them from any subsequent alteration by its antiseptic properties But in this case, the salt acts on the surface a long time before it penetrates to the centre, whence results an excess of salt at the surface, whilst the centre is not sufficiently salted, and still contains the principles of fermentation. To avoid this, the habit is to cut up the meat; but this, while it increases the chances of its preservation, greatly alters its quality. In fact, the salt in contact with large surfaces absorbs too largely the liquids con-

tained in the flesh, and extracts from them the aroma and a portion of their nutritive juices. Pork, the tissue of which is dense and protected by fat, bears this preparation better than beef, the flesh of which, after long standing in the salt, presents only a fibrous tissue without flavour, and with but a low nutritive power.

"It results from these facts; first, that meat preserved by the usual process contains necessarily too much salt, and that its prolonged use is injurious to health; secondly, that it loses a part—sometimes a notable part—of its nutritive value.

"The method of avoiding these inconveniences is to salt uniformly and not sub-divide too far the meat, thus preserving its aroma and its juices; I think that I have found the solution of this problem, and the following are the means that I employ:

"If it is a ham which I wish to salt, I introduce, by means of a trocar, between the bone and the muscle at the small end, a sound which I attach to a stop-cock which communicates by a tube with a reservoir of water saturated with salt, to which are added various aromatics and condiments. The reservoir is from 25 to 35 feet high. When the stop-cock is opened, the liquid by its pressure rapidly separates the muscle, and the two or three ounces of pickle which are necessary for the preparation of one pound of meat, are easily lodged in the cellular tissue which surrounds the bone. Thence it forms a kind of reservoir, the liquid spreads penetrating all the fibres by infiltration, distributing regularly and homogeneously the conservative agent, and producing its first effect upon the parts most susceptible of alteration, that which surrounds the bone. The hams thus prepared are put for some days in a pickle-bath. The object of this bath is to prevent by its pressure the issue of the liquid injected; besides which it completes the preparation by saturating the surface. When they leave the bath the meat has lost nothing of the weight which it had at its entrance. I then expose them to a current of air at a moderate temperature. When by evaporation they have lost the infiltrated liquid and 5 per cent. of their normal weight, I expose them to the action of smoke for a time which varies with their weight This latter operation is not necessary for their preservation, but it gives them a taste which is generally sought for, and effects a reduction of weight. On leaving the smoke-house they have lost from 12 to 15 per cent. of their weight; before entering they had already lost about 5 per cent., so that their whole loss is from 18 to 20 per cent."—*Cosmos.*

Potabilisation of Sea-water by the Electric Current.

In *Macmillan's Magazine* for last month is an interesting paper by Dr. Phipson, entitled, "Electricity at work," in which the author passes in review the useful applications of this wonderful agency. He concludes his paper as follows:—"Reflecting upon the powerful decomposing chemical force with which we are furnished by the electric current it occurred to me that I might be able to render sea-water potable by decomposing and extracting its salt, by means of a moderately powerful battery. The experiments were made at Ostend a few years ago. My apparatus consisted of three vessels containing sea water to be operated upon, the two others communicated with the two poles of the battery. The three vessels were connected by two bent U-tubes filled with sea-water. As the only battery I could procure in Ostend was rather weak, I passed the current through the water for about fourteen hours, after which one of the outside vessels had become acid and the other alkaline. The sea water was then filtered through charcoal, and was nearly drinkable. It would have been, I doubt not, quite potable had the battery employed been more powerful, as it was I found it difficult to extract the last particles of salt; and the water after subsequent trials, still presented a slightly brackish taste. I have not had an opportunity of repeating this experiment since but from the results obtained, I think it probable that sea-water may be rendered potable by means of the electric current."

Michigan Coal Field—The Woodville Company.

In 1858 this company commenced operations, and though, at present, no active work is being carried on, it is hoped that its cessation is but temporary, and that a short season of repose will be followed by one of active and vigorous exploitation. A perpendicular double shaft has been sunk to the depth of 97 ft., including the depth of the pump; this would make, therefore, the vertical distance from the surface to the floor of the coal to be about 90 ft. at this point. The following section taken in the shaft will show the succession of rocks cut through:—

Superficial materials	12 feet.
Woodville sandstone	40 "
Black shale, highly bituminous..	12 "
Fire clay	
Iron ore, varying from 3 to 18 in. (say)	1 "
Black shale	16·5 "
Coal	3·5=90 feet

The "Woodville sandstone" is a light coloured rock with a peculiar tint at this point, not unlike that of the celebrated "Pictou sandstone;" it is soft, friable, and weathers rapidly. The fire-clay is a good article, apparently, and ought soon to find some economical application.

Though called but one, the vein appears to us to be two distinct seams, separated by a thin band of highly bituminous shale, and marking two distinct and widely different qualities of coal. The upper seam is of some 15in. thickness, and the coal is much freer from pyrites than that occurring in the lower one. The presence of this mineral in a very appreciable quantity in the coal of Michigan has been a source of much annoyance and considerable trouble to those who have used it to any extent, and accounts in a measure for the comparative ill success of most of the explorations throughout the coal basin of that State.—*West. R. R. Gazette.*

New Kind of Gunpowder.

Apart from the ancient discovery of Berthold Schwarz, and the more novel invention of gun-cotton by Prof. Schönbein, the feat has just been repeated in another way by two officers in the Prussian and Austrian service. Of these, Hauptmann Schmidt, a captain of artillery at Berlin, is the original discoverer, whose idea was subsequent-

ly imitated and improved by Colonel von Uchatius. The latest explosive material consists of the flour of starch, which, boiled in a peculiar way with nitric acid, possesses a far greater projective force than the gunpowder in ordinary use. It has also the great advantage of not fouling the piece to any appreciable extent, and, from the nature of the materials used, is produced at a far cheaper rate. Another point in its composition which recommends it especially for fortresses and magazines is the facility with which the ingredients are mixed together, thus rendering it possible to keep them separate until wanted for actual use. In this state the powder is non-explosive. The experiments now in course of progress in Vienna and Berlin are said to leave little doubt as to its general adoption in the Austrian and Prussian armies.

Heat Evolved by the Combustion of Carbon in Siemens' Gas Furnaces.

Carbon burnt perfectly into carbonic acid in a gas producer would evolve about 4000° of heat; but, if burnt into carbonic oxide, it would evolve only 1200°. The carbonic oxide, in its fuel form, carries on with it the 2800° in chemical force, which it evolves when burning in the real furnace with a sufficient supply of air. The remaining 1200° are employed in the gas producer in distilling hydrocarbons, decomposing water, &c. The whole mixed gaseous fuel can evolve about 4000° in the furnace, to which the regenerator can return about 3000° more.—*Faraday.*

Method of Colouring Pickles green without the use of Copper.

Into the preparation of pickled vegetables, remarkable for the intensity of their green colour, a preparation of copper, often in large proportions, almost always enters either directly or indirectly. This practice having been very justly condemned, attempts have been made to obtain the same colour with innocuous agents. Nothing succeeds better than boiling the vegetables in water made slightly alkaline sometimes either with a small quantity of bicarbonate of soda, sometimes with lime-water, and sometimes with saccharate of lime or with water containing a quarter of an ounce of liquid ammonia to the quart.

Coinage of the British Mint.

Seven million & a half of sovereigns and over a million of half-sovereigns were coined last year. Since 1852, sixteen millions of florins, twenty-four millions of shillings and twenty millions of sixpences have passed through the Mint. During the same period forty-seven thousand silver two-penny pieces, eighty thousand silver pence, and a large quantity of silver three-half-penny pieces were issued, the latter for circulation in Ceylon. The coinage of half-farthings ceased in 1856, when 913,000 were struck; The total value of all the pieces coined since 1852 to the beginning of the present year is about £64,000,000.—*Athenæum.*

Photography Appreciated.

The municipality of Ghent so highly appreciate the value of Photography that they have established gratuitous lectures on the subject, of an instructive character.

Captain Coles' Shield Vessel.

Captain Coles's plans were submitted to the Admiralty in 1859, long prior to the construction of Ericsson's battery. These shields and the *Monitor's* are much alike in principle; but Captain Coles's vessel is a far better sea boat than the *Monitor*, and carries twelve guns instead of one, as in that vessel. Coles's shield has a conical roof, and carries one or two Armstrong 100-pounders fixed in slides, which are parts of the interior of the shield, that moves round on a central pivot, and the men working the guns are turned round in it entirely under cover. The construction of the shield ship designed by the Admiralty is altogether better than the *Monitor's*. The speaker does not wish, however to see our war ships replaced by vessels of this class, but by those worthy of ourselves—a fleet of *Warriors.—T. Scott Russell.*

Production of Salt in the United States.

The making and refining of salt in the United States in 1850 employed 340 establishments, and the value of their production was $2,177,945. The four States of New York, Virginia, Ohio and Pennsylvania, which, in the order named, are the principal salt-producing States, made according to the eighth census, nearly twelve million bushels, the cost of which was $2,200,000, an average of about 18½ cents per bushel. Texas, Kentucky, Massachusetts and California are also self-producing States. About sixty per cent of the whole was made in New York, at an average cost of 17 cents per bushel.—*U. S. Census for* 1860.—*Scient. Amer.*

The Three Hundred Pounder Armstrong Gun.

The 300-pounder Armstrong gun, which, since its proof with 90 lbs. of power, has been in a dangerous state, was on the 7th ult. again used at Shoeburyness against iron plates at a range of 200 yards. The target represented a portion of the side of the new class of steam frigates to which the *Minotaur* belongs. In these frigates the armour is 5½ in. thick instead of 4½ in., as in the *Warrior*; but the thickness of the teak backing is reduced from 18 in. to 9 in. The inner skin and iron framing are the same as in the *Warrior*. For the first three trials the shot was of cast iron, and the charge was 50lb., as usual. No. 1 struck and pierced the centre plate, damaging but not passing through the inner skin and framing. No. 2 struck the upper plate, and went completely through armour, timber, and skin. No. 3 was directed against the lower plate, and, like No. 2, passed right through the target. The fourth shot was of wrought iron, and the charge the same as before. At this round, however, the gun gave way, the breech being blown backwards to a considerable distance. The gun, however, did not break into fragments, and no one was hurt.

The Atlantic Telegraph.

The Atlantic Telegraph Company are to be once more assisted by Government. The Admiralty have undertaken to make a new survey of the bed of the ocean between Ireland and America, and will lend vessels for laying the cable. Should the line be laid successfully, Government will further pay the company £16,000 a-year as long as the cable is in working order.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

OCTOBER, 1862.

THE PROVINCIAL EXHIBITION.

Already the details of this splendid exposition of the progress of Upper Canada, not only in material wealth, but in industry and art, have been scattered broadcast throughout the land by the daily and weekly press. Elaborate and excellent descriptions of the numerous improvements in manufactures, machines, and agricultural implements have been read, no doubt, by the greater portion of the reading public. There remains but for this journal, which as yet only ventures upon a monthly issue, to record the facts which have been made patent to all, and which by the time these pages meet the eye of our readers, will have become matters of history, so rapid is the progress of events with us.

Among the tens of thousands who visited the Provincial Exhibition last week, there were some who were able to go back in mental review to the time when a dense forest covered Upper Canada from the Ottawa to the St. Clair; when the Province which has so recently displayed such a magnificent collection of grain and fruits, of domesticated animals and home manufactures, was an almost uninhabited and pathless wilderness. If the recollections of those now living can carry them to the dawn of the history of Upper Canada, how bold may be the aspirations and predictions of those who in the full vigour of manhood contributed towards the seventeenth Exhibition of Upper Canadian industry, enterprise, and skill. Each succeeding year has attested in a remarkable manner the rapid progress of the country, but on no former occasion did the resources of Upper Canada exhibit themselves to such advantage as during the last week of September in the present year. Many fortunate circumstances assisted in giving effect to the display—the presence of illustrious visitors, the continuance of most favourable weather, a bountiful harvest, and a happy revival of general prosperity—all contributed to make the exhibition held at Toronto, not merely far superior to its predecessors, but a striking and truthful representation of the progressive civilization of the western half of the Province.

Well might Lord Mulgrave express his astonishment at what he witnessed when he contrasted the scene before him, with all its evidences of industry, energy, activity, with the wilderness from which the accumulated wealth was won. Reflecting men will endeavor to trace the probable future of a people who during the present century have increased from a few thousands to more than a million and a quarter; who came to a wide waste of dense woods and gloomy swamps, and within the memory of thousands now living have converted it, by dint of the labor of their hands and the energy of their will, into a land of rich farms, producing thirty million bushels of wheat; fruits surpassing in every point, the skilled productions of the father land; cattle and horses equal in many respects to the best; and as a people preserving, notwithstanding 3000 intervening miles, a singular attachment of loyalty to the institutions and throne of the country under whose protection they maintain inviolable the greatest freedom and the utmost respect for the law.

It was generally supposed that the late Exhibition would surpass all its predecessors chiefly on account of its being held at the capital of Upper Canada. In this respect most anticipations were fully realized. There was, nevertheless, some want of arrangement in the so-called Crystal Palace, which might have been remedied if more time had been bestowed upon the distribution of the articles exhibited, and if opportunity had been offered for completing arrangements before the public were admitted. In some instances, the judges found great difficulty in discovering the articles of which they were in search. Such disorder is by no means a necessary accompaniment of the sudden assemblage of a large number of contributions of every conceivable variety. The printed classified catalogue, always ready weeks beforehand, serves as an excellent basis on which a regular plan of arrangement might have been adopted. It seems absurd to place articles belonging to the same class in different parts of the building, although it may happen, as was the case in this present instance, that the manner in which different articles are presented for exhibition precludes their being placed side by side. In one or two instances great carelessness was apparent, though with whom the fault lies does not appear. A case of fish, for instance, was exposed to public view, just as if it had come from a long journey, with its contents jumbled together. The admission of the public before the judges have completed their rounds is always objectionable, and must materially interfere with that quiet discussion respecting the worth of different articles, so needful in awarding positions of merit. The inconvenience arising from dust was much felt in the

interior of the building. Apart from these imperfections, which, while they greatly mar the general impression produced upon the public at large, and which are by no means unavoidable, the appearance of the "Crystal Palace" was attractive and encouraging. The number of agricultural implements of every description on the Exhibition grounds was very considerable and indicated the change which is rapidly and completely taking place in the details of farm work.

Among a vast number of articles worthy of special notice, we may mention the woollen cloths of Canadian manufacture exhibited by the Port Dover Woollen Factory. The Ontario Woollen Mills of Cobourg produced some excellent specimens of goods manufactured at that establishment. Brockville, Grafton and Georgetown also distinguished themselves by sending capital broad-cloths, blankets, woollen carpets, &c. The names of the proprietors of these different establishments are as follows:

1. Port Dover Woollen Factory, built by a Joint Stock Company, and rented to J. N. Pitts.
2. Ontario Woollen Mills of Cobourg, Messrs. Fraser & Co.
3. Georgetown, W. Barber & Brothers.
4. Brockville, Ezekiel Snyder.
5. Grafton, Platt Hinman.
6. St. Catharines, Disher & Haight.
7. Victoria Woollen Mills, Almonte, Messrs. B. & W. Rosamond.

The different samples displayed were of excellent material and very creditable manufacture. There can be no longer any question that Canadian broad-cloths, woollens and carpets will rapidly gain favour in public estimation if the markets are supplied with articles equaling those exhibited at the Provincial Exhibition.

Mr. Sheppard's fuel-saving fire place, of which a full description is given in another place, altho' involving no new principle, is an ingenious artifice for saving much of the heat which is usually allowed to find its way, with hot air and smoke, up the chimney.

The presence of three portable steam engines from different firms, (Beckett & Co., of Toronto, Zealand of Port Hope, and Ganson, Watrous & Co. of Dundas,) show how the attention of the farming community is directed to steam as a farm adjunct, in a country where horse-power machines are scattered broadcast over the land. The collection of Reapers, Mowers, Cutters, Ploughs, and indeed every variety of agricultural implement, was very large, and indicated more general progress in the adoption of labour-saving machines of an expensive character, that any one disposed to view Canada as a "new country" could regard without admiration and surprise.

The receipts of the seventeenth exhibition exceeded those of last year by about $3,800. The total amount taken being about $16,000. The financial part of this great annual gathering being as satisfactory as was the exhibition itself, whether viewed in the light of an orderly assemblage of a vast number of individuals met together for the purposes of enjoyment, instruction or competition, or as an exposition of the progress of the country in those industries which constitute the material wealth of a state.

THE PROVINCIAL EXHIBITION.

Why was there not an Address?

It has been the custom at the close of our annual exhibitions for the President of the Association to deliver an address, which was supposed to embody remarks on the progress of the country in agricultural and manufacturing industry, and to glance at the improvement it is making in civilization. This year the address has been omitted. We cannot agree with the opinion expressed by Col. Thompson at the meeting held at the close of the exhibition, that "Mr. Stone deserved credit for the moral courage he had displayed in bringing to an end the practice which had hitherto prevailed of an address being annually delivered by the retiring president." We think that it is rather to be deplored that Mr. Stone should have permitted so favourable an opportunity of recording the progress of the country in material things to slip by. The addresses of the Presidents of our Agricultural Association do, or ought to embody a vast amount of information, which would be eagerly read by people at home and abroad, and coming with all the authority of the highest representative of the agricultural and manufacturing industries of the country, they would carry weight with them which other emanations might very probably not possess. It is an opportunity for the spread of information respecting the resources and climate of the country, the industry and activity of its people, the increase of their wealth, the progress of their education, their submission to order and law, and their rise in the scale of civilization, which nothing is more calculated to establish than the fruits of their skill, so abundantly displayed at our annual exhibitions; forming a theme which every patriot should rejoice to enlarge on. If there were no signs of activity and progress visible, no improvement to note or advance to record during the retrospect of the year, then might the annual address be dispensed with without regret, as it would

only serve to show degeneracy or apathy. But where success and improvement are so manifest, where mind to conceive and skill to execute are so striking, where no retrograde movement is visible, but all is securely advancing, it is for the interests of the country that this forward movement should be published under the best authority the agriculturists and manufactnrers of the country are supposed to possess. It is urged that the demands upon the time of the President—who is very properly selected from the practical farmers of the country—or a want of familiarity with literary efforts, are cogent reasons why the address should be abandoned; but if this reasoning were to hold good elsewhere as in Canada, the addresses of Presidents would be few and far between, and many of those luminous and delightful retrospects of progress in different branches of art and science from which we derive our knowledge of what has been done during the year that is past, would have never seen the light. It is not necessary that every president should himself collect all the facts and discuss the merits of the events of the year, or even write any portion of his own address. In many instances this would be a difficult effort, or a task which few could accomplish with credit; it is sufficient if the sentiments which are uttered, or the statements which are made, are endorsed by the President, in order to secure the weight which always attaches to such an authority. No one supposes that the annual address of the President of the Royal Geographical Society, except in some few instances, is written by himself, a considerable part of it may be, but much is prepared for him by those whose business of life it is to make themselves familiar with the progress of geographical discovery. So also it should be with the Presidents of our Agricultural Associations. If they do not feel themselves competent to present to the public a retrospect of the progress made in the country during the past year, there can be no difficulty in procuring the assistance of friends who would furnish the desired information, and if necessary put it into shape.

Mr. Mayor Bowes also "thought that the retiring President had acted judiciously in departing from the custom of delivering a written address;" but he gave an excellent reason for their being continued. "I am sorry," said Mr. Bowes, "that I am not a practical farmer myself, that I might share with them the glory of the testimony which was borne by the noblemen from England and Ireland, to the excellence of their cattle, the magnificence of their horses, and the superiority of the products of the mechanical genius of the country now exhibited on these grounds." It is the very excellence of which Mr. Bowes speaks that should be noticed and described in the annual address of the President of the Association. The admirable and eulogistic speeches of Lord Monck and Lord Mulgrave will be read with delight and enthusiasm by the farmers throughout the country, but we want a calm and collected retrospect of the years that are past, and of our progress in all things pertaining to agricultural and manufacturing improvement, which should come from the lips of the President of the Association. These are necessary reviews of our onward march in material wealth, deriving as we do great external aid from emigration, and the introduction from abroad of so much which tends to improve our condition. We hope that the Agricultural Association and the Board of Agriculture, rather than lending their influence towards the discontinuance of the annual address, will give such counsel and assistance, when required, as may make the address of the President of the Association a document of general and substantial value, fitted to command respect both in Canada and across the seas. It ought to embody a synopsis of what we have done, so as to lead the stranger who criticises us to form some conception of what we may be expected to do.

THE FISHERIES OF THE GULF.

The Lower Provinces are attracting considerable attention at the present moment in consequence of the projected Intercolonial Railway. The great fisheries they command in the Gulf of St. Lawrence, and on the Atlantic coast constitute the most important source of their wealth, as well of the Eastern Townships in Canada. As this subject is one not generally appreciated in the Upper Province, we shall devote a short space to the consideration of our Fisheries.

The commercial and political importance of the North American Fisheries has been recognised for more than three hundred years. They have attracted the earnest attention, at different periods, of the Spanish, Portugese, French and English Governments, and have been made the subject of special treaties after the termination of protracted, expensive and sanguinary wars. The navy of France was sustained during the first half of the eighteenth century by the Fisheries of North America. Without this admirable nursery for seamen France would not have been able to man the tithe of her fleets at that period. We have only to glance at Louisberg, and the treasure lavished on that once splendid harbor and magnificent fortress, on the island of Cape Breton, to feel sensible of the vast importance with which the

North American Fisheries were invested by France at an early period, and to the grasping policy of Louis Napoleon during the last four or five years, with respect to fishing rights on the coast of Newfoundland, for a proof of the anxiety with which he wished to retain and improve them as a nursery for seamen. The fortifications of Louisberg cost thirty million livres, and when taken by the British forces from New England, under Sir William Peperall, for the first time, in 1745, the annual value of the fisheries to the French, which built up Louisberg, were nearly one million sterling, independently of their being the best nursery for seamen the world ever saw.

The city was built to a great extent of bricks brought from France. The walls were defended by more than two hundred pieces of artillery. During the seige 9,000 cannon balls and 600 bombs were discharged by the assailants, and the city was taken on the forty-ninth day after investment. The conquest of the city was regarded by Smollet as the most important achievement of the war of 1744; and the First Lord of the Admiralty at the time declared, that "if France was master of Portsmouth he would hang the men who would give Cape Breton in exchange." Louisberg was restored to the French at the peace of Aix la Chapelle, in 1748; but in the succeeding war it was again invested, in 1759, and the force then employed consisted of twenty-nine ships of the line, eighteen frigates, a large fleet of smaller vessels, and an army of fourteen thousand men, and within three years of a century preceding the fall of Sebastopol, the churches throughout the British empire were thronged with thankful worshipers in gratitude to the Almighty for the success of the British arms, and the second fall of Louisberg.

Louisberg may yet rise again. The site of this ancient fortress and capacious harbor is two hundred miles nearer to Europe than Halifax, and the island of Cape Breton is separated from the mainland by the Gut of Canso, not more than 900 yards broad at its narrowest part. Across this narrow strait a steam railway ferry could always keep up communication with the mainland, and yet leave free this valuable entrance to the gulf. (1)

(1) The Gut of Canso, separating Breton Island from Nova Scotia, is frequented by a great number of vessels, amounting to some thousands annually, who pass through it from the Atlantic to the Gulf of St. Lawrence. Admiral Bayfield considers it by far the most preferable route for homebound vessels trading between the southern ports of the gulf and Great Britain, as it affords a safe anchorage until an opportunity for sailing with the first fair wind. The length of the passage of the Gut is 14½ miles, and its least breadth 900 yards. The depth of water is seldom less than fifteen fathoms. Cape Porcupine, on the western shore, rises 640 feet above the sea, and is a very remarkable object. The rocks on each side belong to the Lower Carboniferous Series.

The political importance of the North American Fisheries to France and the United States, have been the cause of the extraordinary efforts made on all occasions of the renewal of treaties by these powers, not only to maintain the position formerly won by their diplomacy, but to take every conceivable advantage of this great nursery for their seamen. The Government of the United States have paid not less than $12,944,998 for bounties to vessels engaged in the fisheries since the commencement of the Republic (1), and the average amount now paid annually by the Government is very nearly $340,000. So great is the impetus which the system of bounties has given to the American fisherman that while in 1795 only 37,000 tons of shipping were employed in the Cod fishery, at present there are upwards of 110,000 tons engaged in this lucrative business.

The convention between Her Majesty and the Emperor of the French, relative to the rights of fishery on the Gulf coast of Newfoundland, in the Straits of Belle Isle, and the neighboring coasts, signed at London, January 14th, 1858, created alarm in Newfoundland, and much excitement and anxiety in other British Provinces interested in the fisheries. In 1857, the Speaker of the House of Assembly, Newfoundland, addressed an urgent letter to the Speaker of the House of Assembly, Canada, relative to this convention expressing the opinion that "the ultimate effect of the operation of this measure will, it is confidently believed, be the depopulation of the colony of its British inhabitants, and the consequent possession of Newfoundland by a foreign power." A Select Committee of the House of Assembly of Newfoundland reported on the 26th of February, 1857, and submitted resolutions most strongly condemnatory of the convention, as ruinous to British American interests. An address to the Secretary for the Colonies was framed and adopted, and all constitutional steps taken to arrest the calamity with which the convention threatened them.

The "taking of bait," which consists of herring, capelin and launce, on the coast of the gulf, is perhaps the most material and important question with regard to the fisheries; for without bait the cod fisheries on the Banks and elsewhere, in deep water, would be comparatively valueless. The French were most anxious to obtain the right to purchase and fish for herring and capelin to be

(1) The bounty, according to the laws of 1855, is as follows:—

A vessel between 5 and 30 tons, receives . . $3 50 per ton.
" more than " " . . 4 00 "

The small State of Massachusetts has received since the Declaration of Independence bounties to the amount of $7,926,273, and Maine, contiguous to New Brunswick and Canada, the sum o $4,175,050.

used as bait on the south coast of Newfoundland—the traffic in bait being expressly forbidden by law. The value of bait sold in 1856 to the French was estimated by competent authority at not less than £58,000. (1) The price which the French give for bait operates as a very seductive temptation towards illicit traffic. In 1856 an average of 26s. to 27s. sterling a barrel was paid by them for herring sold for bait, while the actual legitimate value of herring for exportation was at the same time only 6s. 1d. sterling. Hence the premium on the illicit traffic amounted to one pound sterling per barrel of 200lbs. A reduced supply of bait to the French fishermen is equivalent not merely to a corresponding diminution in their catch of fish, but to a much larger supply of cod on the British American coast, which, after feeding for a certain period on the great banks, resort to the coasts in pursuit of the herring, capelin and launce. If the French have an abundant supply of bait, the fish linger on the banks as a feeding ground. The tonnage fitted out yearly for the French bank fishery slightly exceeds 18,000 tons.(2) The right to dry and cure on shore is of the greatest importance, as not only are fish so cured of much superior quality, and consequently command a market where indifferent samples are unsaleable, but facilities for doubling or trebling the ordinary catch are greatly augmented.

The bounties paid by France during the nine years from 1841 to 1850, inclusive, for the Cod fishery only, had amounted to the annual average of 3,900,000 francs. The number of men employed annually in the fishery amounting to 11,500, the bounties would therefore be at the rate of 338 francs per annum, per man. France thus trains up hardy and able seamen for her navy.

This notice, already, perhaps, too much prolonged, of the importance of the Cod fisheries of Newfoundland, the Great Banks, and the Gulf of St. Lawrence, may be appropriately brought to a close by a quotation from a French official document of great interest and weight.

"Nevertheless, the loss of her magnificent colonies has occasioned irreparable injury to her commercial marine, which is an essential element of naval power. Treaties, which became inevitable in the course of time, have successively robbed her of the most valuable objects of freight. Cotton belongs to the Americans, coal to the English; and at the present moment, the shipment of sugars, our last resource for distant navigation, seems to be daily growing less and less.

"The GREAT FISHERIES STILL REMAIN to US; and in order to preserve them we must continue the encouragement they have received, even at periods when a commercial and colonial prosperity, infinitely superior to that now existing, multiplied our shipping, and created abundance of seamen. In fact, the fisheries give employment to a great number of men, whom a laborious navigation, under climates of extreme rigor, speedily forms to the profession of the sea.

"*No other school can compare* with this in preparing them so well, and in numbers so important, for the service of the navy." (1)

M. Coste, of the Institute of France, submitted a report to the Emperor, during the present year, whose title shows the interest taken in this prolific subject. "On the organization of Fisheries as regards the increase of the Naval Force of France."

The total value of the fisheries of the Gulf, exclusive of the Banks of Newfoundland, amounts to upwards of fourteen million dollars per annum. The Gulf of St. Lawrence is not only an inland sea of inestimable value for its great fisheries, but is a most splendid nursery for seamen, and will one day be regarded by the British American Provinces as their noblest inheritance.

THE BENDING OF WOOD.

The applicability of bent wood for an increasing variety of purposes is both surprising and instructive. Here in this great lumber country, and in many others, it is used in all departments of business and pursuits of life wherever man and his products are known. It is as ancient as history, and is found among the artifices employed in the rudest state of barbarism. Little is known of the most ancient devices for bending wood, but the oldest patented in England has now been practised for nearly a century, and is yet used there for some purposes. In 1813, at Woolwich Navy Yard, England, floor timbers, sixteen inches square, for a man-of-war, were bent over an arc of a circle with a radius of four feet. All these devices, as well as almost all others subsequently used, restrained, in some degree, that tendency found in wood to elongate its outer curve when

(1) Governor Darling.

(2) The anxiety with which the assent of the Government of Newfoundland to the "Convention with France" was viewed by the British Government may be inferred form the following extract from the despatch addressed by the Secretary of the Colonies to Governor Darling, in 1857:—Such are the outlines of the Treaty, which I now transmit to you. Deeply anxious as they are to effect the settlement of questions so complicated and so pregnant with possible mischief to both countries, Her Majesty's Government have, nevertheless, not thought themselves justified in departing from that rule of Colonial government which is now so firmly established in British North America." * * *

(1) Report rendered in the name of the Commission for the enquiry into the projected law relating to the Great Sea Fisheries, by M. Ancet, 1851.

under the operation of bending, the same as is now claimed to be done in apparatus brought as near the state of perfection as the nature of wood and the change of position the particles undergo will admit. The organic structure of all woods of the endogenous or internal growths, and the exogenous or external growths, are similar, and possess the qualities of cohesiveness and compressibility more or less, differing most in the degree or quantity of these two qualities, which make and determine the amount or degree of flexibility or elasticity in any wood. These qualities, with a structure that will admit any fluid agency to thoroughly penetrate and soften its tissue, indicate a wood that may be made to assume any curvilinear shape required for practical use. Then only ordinary skill and judgment would be required to operate on good wood—bending successfully, without any loss occurring from breakage of the wood under the operation of bending, but where the wood has not been seasoned or partially seasoned, a trifling loss will occur from breakage caused by the shrinkage that all woods are subject to in the process of seasoning. And in the case of unseasoned bent wood, this shrinkage acts upon the fibre of the outer curve, which is always at the point of tension, if not in an actual state of severe tension, for the reason that in deflecting any substance, but particularly wood, either with or without partial restraint, to oppose tension, the wood is acted upon by two forces, the one a crushing force that foreshortens and contracts the lesser or inner curve, with a tendency to rupture it laterally, the other a tensile force that stretches and elongates the greater or outer curve, with a tendency to fracture it transversely and lift the fibre, which is the most hurtful, and of the more frequent occurrence. These two forces are divided by a neutral line, more or less removed from either curve. When nearest the inner curve the best result is obtained, because all tension, however little, is injurious to the structure of the wood, arising from separating and drawing out the fibre, which can never be made to unite again, as in ductile and malleable substances, and because the crushing or compressing force improves the wood by forcing the fibre into the interstices or cells, and by interlacing and interlocking the fibre, the product is obtained nearly resembling the knot or knurl, which is difficult to split or cut, even when rupture is indicated.

In order to get the best result from bent wood, it is recommended that the crushing force alone be used. And this can be, if the fibre of the wood be left free to move into a new position in more than one direction from the point of bending, by beginning the curve in the middle of it when the wood is made to assume a long curve first, before taking the shorter curve of the mold, which long curvature starts the fibres throughout, and makes more, if not every particle of the wood, accessible to the influence of the softening agent already in it, and consequently more yielding to the action of the crushing force. This force should be produced and governed by fixed and immovable restraint that should not compress the wood while in its straight form. It should also prevent end expansion and preserve the exact length on the outer curve. This would give a product uniform in density and rigidity throughout its whole length, with the fibre undisturbed on the outer curve, to resist any tendency to change the shape produced. The long curve gradually adapting itself to the curve of the mold, would amount to double on successive manipulation, if unrestrained; wood has been compressed into one-third of its primary bulk, with every quality improved to resist decay and wear in use. Nothing can be reasonably urged in support of the popular belief of the necessity to produce or permit tension and elongation in successful wood bending. Tension and elongation are required or permitted only in consequence of the uses of imperfect apparatus—elongation is positively indispensable in machines that bend from one end, or in one direction from the point of bending, and that press the wood against the mold with such power as to prevent all movements of the fibre, producing in advance of the point of bending, a wave-like movement among the fibres of the wood, held rigidly confined and straight, until suddenly made to take the curve of the mold. The movement in advance of the bending gradually accumulates a power that resists compression thus attempted, and before the completion of the process, and in order to save the machine or the product, relaxation of restraint is required, and is followed by elongation of the wood, however small it may be. Tension acts upon the fibre, giving a product uneven throughout its whole length, and more liable to change the artificial shape. It is obvious that any augmentation of restraint during the process, must give just such results, and that the machinery in use for the bending of wood is far from having reached perfection. There can and will be machinery constructed to bend large timbers for marine and other structures, over any arc or curve that will not require a reduction of its bulk, by the compression of the inner curve, to less than one-half its lateral size. Past experience has shown that wood-bending machinery is most profitably employed in the production of smaller articles, for which there is an unlimited demand that will con-

tinue because of the suitableness and superiority of bent wood for these purposes.

Iron or jointed structures are generally used on a large scale; but there can be no doubt that timber of the most imposing dimensions can be bent into many convenient forms, with considerable increase to its strength and the appearance of the structure in which it is employed. The subject is well worthy of the attention of inventive mechanics. Steaming wood, previously to submitting it to a bending force, is now employed.

THE PRICE OF CANADIAN PETROLEUM.

The *Oil Springs Chronicle* of Sep. 24th contains an article on the Oil Association and its advantages. After enumerating some beneficial results which at once arose from the united action of the Oil-men of Enniskillen, the *Chronicle* says:—Oil is now one dollar per barrel, and as the season approaches, orders begin to increase in quantity and value. No one thinks of disposing of a barrel of oil short of one dollar. It will never again sell below that price, but will constantly appreciate until the proper standard is reached.

"These results have been brought about by the Oil Association. This no one will attempt to deny. And it is a matter of satisfaction to reflect that whilst we have associated ourselves together for promotion of our own interests, and for the protection of ourselves, we have worked no injury to any one else. We have determined to receive a fair and uniform price for our oil. That price is still very far below its acknowledged intrinsic value; and until it is raised above that, no one has a right to complain."

We are quite sure that no one would for a moment grudge a fair and remunerative compensation to the well-owners for the time and capital they have expended, the anxieties they have suffered and the risks they have run, in developing the oil resources of Enniskillen. But there is danger in any attempt to raise the price of an article beyond its legitimate commercial value by any and every kind of monopoly. There are always two parties to a transaction, the buyer and the seller. If the Oil Association raise the price of their oil beyond a certain margin, which is well defined at one dollar a barrel, buyers will seek more liberal markets. The object of the Association should be to attract the attention of Commercial men in Europe to their oil on account of its abundance and cheapness. Raise the price of the oil and another market will be sought. We believe that oil will be found over a large area in the United States on the rivers or near the boundaries of the great coal fields, which indicate pretty accurately the geological position of the Devonian rocks in which the oil has accumulated. These rocks have an immense spread in the United States, and indications of accumulations of oil are now known to exist over a very broad area. There is every reason why the supply of oil should be equal to the demand, and it is perfectly well known among commercial men that when a trade has once taken a certain direction, it is most difficult to divert it. The American oils are now well known in Europe, the Canadian oils are only beginning to be known. It is of the utmost importance that European importers should be made aware of the facts, namely, the permanency of the supply, the accessibility of the material, and the absence of any monopoly to keep up the price. Monopoly of a natural product stinks in the nostrils of the commercial men of the present day; the Oil Association of Canada can make no more fatal mistake, than that of raising the price of the oil beyond a fair source of remuneration to themselves; and if by this means the trade should be directed to the United States and the foreign buyer seek for his supply in the cheapest market, where no monopoly to keep up prices exists, the Oil Association of Canada can neither expect sympathy nor encouragement. One dollar a barrel affords, we are informed, a handsome profit to the well-owners. If the Oil Association goes beyond this mark, they will certainly entail ruin on the trade, or be compelled to reduce their price below the proper margin. Already American petroleum commands a higher price in Europe than Canadian, because it contains more of those lighter oils which are valuable there for different purposes in the Arts. We do not expect to see Canadian oil higher than one dollar a barrel, we should not be surprised if the Oil Association found it to their advantage to reduce the price rather than to raise it. The laws which govern the relations of buyer and seller are unalterable in the long run, and, in these days of commercial freedom, far removed from the influence of monopolies.

WHERE A LARGE PORTION OF OUR SURPLUS PRODUCE GOES.

People not conversant with the mysteries of distillation and brewing will be surprised to learn that nearly all our farm crops are made to contribute more or less to the supply of that bane of this country, and indeed of this continent—Spirituous Liquors. Wheat, barley, rye, Indian corn, peas, buck-wheat, mill-feed, oats and potatoes, are all enlisted in the service of the distiller and the

brewer. Last year (1861) upwards of one million, three hundred thousand bushels of grain, and four hundred and fifty-five thousand bushels of malt were consumed in manufacturing spirituous and malt liquors. The number of distilleries in Canada West, in 1861, was *seventy;* in Canada East, *four.* The quantities of the different kinds of grain consumed in this way form a curious table, shewing the various sources from which the poisoned cup is filled to overflowing, and how steadily the production is increasing year by year.

The following table shows the quantities and kind of grain used for distillation in Canada, during the years 1859, 1860 and 1861. No doubt much that goes to the distiller is of inferior quality and scarcely fitted for any other purpose; and if the product obtained by distillation were only used in manufacturing processes, there would be no one to regret its final disposition; but when there is no doubt whatever that a large proportion is employed in the manufacture of intoxicating liquors of the worst description, there arises a subject on which the philanthropist may amplify to the benefit of thousands of his fellow-countrymen, and the relief of society at large.

USED FOR DISTILLATION.

	1859. Bushels.	1860. Bushels.	1861. Bushels.
Malt	114,651	108,347	100,603
Wheat	22,231	21,022	22,490
Barley	47,647	42,112	27,256
Rye	154,286	179,627	233,554
Indian Corn	511,846	409,795	542,989
Peas	1,880	4,816	2,851
Buck Wheat	1,532	2,812	2,494
Mill Feed	63,457	88,622	92,637
Oats	291,355	416,744	323,955
Potatoes	25	1,391	54
Molasses or other substances	37,766	20,794	....

The total quantity of grain used for distillation in the same years was as follows:—

	1859. Bushels.	1860. Bushels.	1861. Bushels.
Total of Grain...	1,208,909	1,275,288	1,348,883
	Gallons.	Gallons.	Gallons.
Proof Spirit dis..	3,239,870	3,327,819	3,817,660

USED FOR BREWING.

	1859.	1860.	1861.
No. of Breweries in Canada W.	128	122	138
" " " E.	22	21	22
Total	150	143	160

	Gallons.	Gallons.	Gallons.
Quantity of Malt Liquor produced	3,488,271	4,249,934	4,898,995
	Bushels.	Bushels.	Bushels.
Quantity of Malt consumed	326,834	386,624	455,001

The total quantity of grain and malt employed by the distillers and brewers of Canada in the three years before named is as follows:—

	1859. Bushels.	1860. Bushels.	1860. Bushels.
Total quantity of Grain and Malt consumed	1,535,743	1,661,912	1,803,884
	Gallons.	Gallons.	Gallons.
Total quantity of Spirits and Malt Liquors manufactured	6,728,141	7,577,753	8,716,655

The excise duty last year on spirits, at 6 cents a gallon, amounted to $229,059, and on malt liquors, at one cent a gallon, $48,989.

We export a mere trifle of spirits and malt liquors; hence we may assume that the produce of this country is consumed at home; and, therefore, the actual average quantity of beer and spirits drank by each individual in the province amounts to nearly seven gallons per annum. But the returns are for proof spirits, or about 50 per cent. alcohol and 50 per cent. water. Whiskey—the common form in which spirituous liquors are consumed—contains rarely more than from 25 to 30 per cent. of alcohol; consequently, although a very considerable margin is allowed for the employment of spirits in manufactures, yet it appears that the average amount consumed by every man, woman and child in Canada exceeds nine gallons per annum.

It is certainly one sign of progress—but not of the kind which would be selected by preference—that as a people we have grown to such an extent in little more than one generation, that we are able to consume in the shape of alcoholic liquors, manufactured by ourselves, more human food than our forefathers could raise throughout the length and breadth of Upper Canada. We have made vast progress in creating material wealth, but it also apparent that we have made equally great progress in intemperance. In a former article on the Cultivation of Wheat in Canada, the gradual disappearance of that cereal in Lower Canada was adverted to. It will not fail to strike the reader who may glance at this page that no increase has taken place in the number of breweries in Canada East since 1859. In that year there were five distilleries in the eastern half of the province, now there

are only four.* It does not appear from the data at hand whether any considerable importation of Upper Canadian spirits and malt liquors takes place. It is probable that such is the case; but under any circumstances, where the raw material and the process is so cheap, it is astonishing that so small an amount of capital is employed in brewing and distilling in Lower Canada. It only proves that the character which the French Canadians have long enjoyed for docility, temperance and contentment is, with respect to temperance, borne out by statistical facts. There are many who would be inclined to regard a passive and quiet journey through life, with sobriety and contentment, as far surpassing the feverish rush for, and attainment of, wealth or position, with those concurrent evils of intemperance and its vicious train, which too often, but not necessarily, go hand in hand, where the chief object of men's lives appears to be the acquisition of riches and power.

SHEPPARD'S FUEL SAVING FIRE-PLACE.

This improved fire-place, which was shown at our Provincial Exhibition, is an adaption of hot air flues communicating with the external air, and an arrangement for the combustion of smoke, to the ordinary American grate.

The grate is fixed upon the stone or marble facings of the chimney-piece, in the usual way; but instead of being backed up solidly with brickwork, a flue is constructed at the back, sides and over the top of the fire. This flue is supplied with air from the outside of the building by a duct, which passes under and through the hearth into it. The vacancy between the arch over the grate and the shelf of the mantle-piece forms the upper part of the flue. The air within the flue, being heated by the fire, ascends and is admitted into the room by perforations in the shelf which are concealed by bottomless vases. In an experiment made with an ordinary fire, a rapid current of air was emitted from a perforation two inches in diameter, at a temperature of 162°. It was speedily diffused, and gave a good supply of fresh warm air to replace what was carried up the throat of the chimney; thus establishing an efficient ventilation without cold draughts from the crevices of doors and windows; and economising the heat of the back and sides of the fire. An intervention of soap-stone between the iron plates of the flue and the fire, prevents the, what is popularly called, "burning" of the air.

The smoke is consumed by being brought, in its most heated state, into contact with a current of air passing towards the throat of the chimney, by means of a plate projecting over the fire; and also by a current of hot air introduced through orifices in the back plate of the fire-place.

The air for the support of combustion in the grate, is supplied by a duct from the outside of the building, to avoid the cold draughts which would be produced by drawing the supply from the room.

The advantages of this arrangement are twofold: First, it serves to economise heat, by utilizing a large portion of that which is allowed to escape up the chimney in fire-places constructed in the ordinary way. Secondly, it very effectually provides for ventilation, and while introducing an abundant supply of fresh air into the room, it adds to the warmth and comfort of the inmates by securing a genial temperature. The supply of air can always be controlled by means of valves in the air ducts, or at the orifices of the shelf of the mantel-piece. Mr. Sheppard has some of these improved fire-places ready for inspection at his establishment on Queen Street.

* Tables of the Trade and Navigation for 1861.

Board of Arts and Manufactures
FOR UPPER CANADA.

AGRICULTURAL ASSOCIATION OF UPPER CANADA.

The Annual Meeting of the Association was held in the Central Committee Room, Exhibition Grounds, on Friday September 26th, at 10 A. M. the President, F. W. Stone, Esq., in the Chair.

Fifteen Members of the Board of Agriculture, and the Board of Arts and Manufactures; and about ninety Delegates from the various Agricultural and Horticultural Societies, were present. The President said the first business to be entered into was the election of officers, and that the election of a President for the ensuing year stood first in order.

Moved by John Barwick, Esq., seconded by Hon. H. Ruttan,—"That Asa A. Burnham, Esq., of Cobourg, the first Vice-President of the Association, be the President for the ensuing year."—Carried unanimously.

Moved by Dr. Beatty, seconded by the Hon. John Carling—"That James Johnson, Esq., of London, the second Vice-President of the Association, be the first Vice-President for the ensuing year."—Carried unanimously.

Moved by W. Ferguson, Esq., seconded by the Hon. D. Christie,—"That J. C. Rykert, Esq., M. P. P. for Lincoln, be the second Vice-President of the Association for the ensuing year."

Moved by Aaron Choates, Esq., seconded by D. Wilson, Esq.,—"That Thos. Stock, Esq., of East Flamboro', be second Vice-President for the ensuing year."

Moved by Tho. A. Milne, Esq., seconded by R. A. Hartley, Esq.,—"That John P. Wheeler, Esq., of Scarborough, be the second Vice-President for the ensuing year."

A show of hands being taken, the President declared the vote to be in favour of J. C. Rykert, Esq., as second Vice-President of the Association for the ensuing year.

Moved by J. Young, Esq., seconded by J. C. Rykert, Esq., — "That Col. R. L. Denison be Treasurer of the Association for the ensuing year." —Carried unanimously.

The several gentlemen elected duly acknowledged the honor done them in appointing them to fill such responsible positions in the Association.

Mr. Denison having asked permission to read the financial statements and audit of accounts of the Association, for the past year, the meeting determined to go on with the regular business instead.

Moved by J. C. Rykert, Esq., seconded by the Hon. John Carling—"That the next annual Exhibition be held in the City of Kingston."

The Treasurer said it was necessary, before the motion was put, that the delegates from Kingston should come forward and say what offer of money they would make, and what guarantee they would offer as to buildings for the proper accomodation of the stock.

Mr. Ferguson said the Association ought to have sufficient confidence in the honour of Kingston, without getting the pledge demanded by Col. Denison. Kingston was the first to put up a permanent building. It was the first to erect a Crystal Palace, and Toronto followed suit, and then Hamilton, and then London; and he was quite satisfied that next year Kingston would have better buildings than Toronto had now.

Dr. Beatty said that the Treasurer, in requiring a pledge, was only carrying out the law agreed upon by the Association.

Col. Denison said he did not think the Association could vote upon this motion until it had a pledge from Kingston in writing.

Mr. Flannigan, Warden of Frontenac, Lennox, and Addington, said the City of Kingston and the county of Frontenac were acting quite unanimously and would do everything in their power to make the grounds all they should be, and to put up every necessary building. The Association need not be afraid, but everything necessary would be done. They would find in Kingston better accomodation than they had ever had anywhere else.

Mr. Gildersleeve, Mayor of Kingston, said he held in his hand authority under the seal of the city of Kingston, authorizing him and the members of the Corporation who accompanied him to give a pledge to any reasonable extent the Association might demand.

This paper was handed in, and in the course of the discussion a resolution passed in 1858 was read, affirming, "That it is not in the power of this board to fix the location of the Exhibition in the year 1860, or any year beyond next year, but that in the opinion of the Directors the Exhibition should not in future be held at any place where there are not permanent buildings erected, or assurances given that permanent buildings will be erected, and also that ample accommodation will be afforded." The motion that the Exhibition next year should be held in Kingston was then put to the meeting, and unanimously adopted.

Hon. H. Ruttan gave notice that at the annual meeting next year, he would move that the resolution which had just been read be rescinded.

THE LATE HON. ADAM FERGUSSON.

Col. Thompson said that since they had assembled in Toronto, they had heard announced the death of an old friend of this institution, and he was sure some such resolution as that he was now about to propose would receive the cordial approval of the meeting:—

"That the Association have learned with deep regret that, since the meeting of the Association on this occasion, one of the first and most indefatigable friends of the institution has been called from the scene of his earthly labours, and they desire to record their high estimation of the value of the services of the Hon. Adam Fergusson, of Wood Hill, and the esteem in which he was held by the Board of Agriculture, of which he had been a member since its formation, and also by the farmers of Canada at large."

He said that having had so long and intimate an acquaintance with Mr. Fergusson, he could not submit this resolution without making one or two remarks. Mr. Fergusson was one of the first who were consulted when the getting up of the Association was first spoken of. He thought it was a difficult undertaking, but consented to give his as-assistance, and he did assist most efficiently. He [Colonel Thompson] was the first President of the Association, and requested Mr. Fergusson to prepare an address. He did so, and it appeared on their transactions as the first of the annual addresses delivered before the Association. And from that day to the present time, Mr. Fergusson had always been ready to give the Association his earnest assistance in everything which tended to advance the prosperity of the agricultural interests of Canada. [Hear, hear.] It was owing to the indefatigable exertions of Mr. Fergusson and a few

others that the Association had attained its present position of prosperity and usefulness.

Hon. D. Christie said—I have a melancholy satisfaction in seconding the resolution which has just beeu moved. I have had the honour and advantage of knowing Mr. Fergusson almost from childhood. He was my father's friend, as well as my own, and I was taught to look up to him as an honest man, and I believe I may say a Christian man. He was long associated, as many of you know, with the advancement of Agriculture in the mother country, being one of those who had the honour of originating the Highland Society of Scotland. [Hear.] When he came to Canada he was not backward to engage in a similar work, and he has lived to see the interests of Agriculture most successfully advanced in this country. While he was amongst us, he was always foremost in every good work. I have had the honour of being associated with him as a member of the Board of Agriculture since its formation, and I can cheerfully and heartily bear testimony to the truth of what has been said by our friend, Col. Thompson, that on every occasion when it was in his power to be present, he has used his utmost endeavours to promote the success of the Agricultural Association. But I know that no words of mine are necessary to endorse his many virtues. His works follow him. [Hear, hear.]

The resolution passed in solemn silence.

Col. Thomson submitted to the meeting a printed draft of a new code of Rules and Regulations, prepared by a committee of the Council of the Association, appointed for the purpose.

After some conversation, it was agreed, on the motion of Mr. Grey, of Woodstock, to defer the consideration of these rules till the next annual meeting of the Association, and that the draft be printed in the *Agriculturist* and the *Journal of the Board of Arts and Manufactures*, for the information of members.

On motion of Asa A. Burnham, Esq., seconded by James Johnston Esq., a vote of thanks was passed to the retiring President, F. W. Stone, for his able and valuable services during the year.

On motion of Mr. Grey seconded by Mr. M. Stover, the thanks of the Association were voted to the Local Committee for the present year, for their valuable services in contributing to the success of the Exhibition.

On motion of Mr. Ferguson, the appointment of the Local Committee for the next Exhibition was referred to the Council of the Association.

The meeting then separated.

Draft of Rules and Regulations

Of the Agricultural Association of Upper Canada, under authority of the Statute 20 *Vic. cap.* 32, *sec.* 33, *and adopted at the Annual Meeting, at Toronto,* 20*th September*, 1862.

Whereas by the Act of the Legislature of Canada, 20 Vic. cap. 32, sec. 33, it is enacted, that "The Directors of the Agricultural Association shall hold a meeting during the week of the Exhibition, and may make Rules and Regulations for the management of said Exhibition;" and whereas, by sec. 34 of the said Act, a Corporation is established entitled "The Council of the Association," with full power to act for and on behalf of the Association between the Annual Meetings thereof; and as it is expedient that Rules and Regulations for the management of the affairs of the Association be adopted; Be it therefore enacted:

1. The Council of the Association, of whom for this purpose three shall form a quorum, shall, during the Exhibition, hold daily meetings, and in the absence of the President and Vice-Presidents a Chairman *pro tem.* may be appointed, and all questions of importance requiring immediate adjudication shall be decided by said Council, and such decision shall be final.

2. The Council of the Association shall attend at an early period in each summer, and at successive times, as may be necessary, with the Secretaries and Treasurer of the Association, at the place appointed for the next Exhibition, and may appoint a Local Committee (if such appointment has not been previously made), and shall make all such preliminary arrangements as may be deemed requisite for the ensuing Exhibition; determining when necessary the plans, dimensions and capacity of the buildings, offices and fixtures, suitable for the proper accommodation of the Exhibition, and everything relating thereto. And in case of anything occurring to prevent the Exhibition being held at the place appointed by the Annual Meeting, such as the failure of the local authorities to provide the necessary buildings, or such like cause, then the Council shall have full power to determine where the Exhibition shall be held for that year, and shall give the earliest possible notice of such change.

3. All contracts, and all lawful proceedings, by, with or concerning the Association, shall be made and had with the Council of the same, and no other contracts, agreements, actions or proceedings shall bind or affect the Association.

4. The Secretaries of the Association shall keep proper records of all transactions and proceedings at the Annual Meeting and Exhibition, and also of the Council of the Association from time to time; and shall, under the direction of the Council, prepare and publish in due time, a Premium List for the Annual Exhibition, with such regulations and information for the guidance of the public as may from time to time be adopted. All entries in the Departments of Agriculture and Horticulture shall be made with the Secretary of the Board of Agriculture; and all entries in the Department of Arts and Manufactures shall be made with the Secretary of the Board of Arts and Manufactures; and

they shall prepare suitable books, and insert therein all articles entered for exhibition in their respective Departments, and under their appropriate classes; and shall make whatever other arrangements may be necessary to secure the fair and impartial exhibition of every article; and, if deemed expedient by the Council, shall prepare and publish, previous to the Exhibition, a Catalogue of all articles entered.

5. The Council shall use great care and adopt such measures as may seem best calculated to obtain the services of competent and disinterested Judges; and to secure these essential ends shall have full power at any period of the Exhibition to change or annul any appointment made.

6. The Judges shall, in the execution of their duties, be careful to act with the most rigid impartiality; shall make their entries in a clear and conspicuous manner, in all cases of doubt or difficulty referring freely to the Secretary, to any member of the Council, or to the Superintendent; and when they have completed their reports, shall sign and deliver their Books to the Secretary of the Department to which they belong, who shall cause the awards made by the Judges, to be transferred to Ledgers prepared for the purpose; giving parties entitled to the premiums orders upon the Treasurer for the payment thereof.

7. At the Annual Meeting, which shall be held at 10 A.M. on Friday of the week of Exhibition, the Directors shall decide the place of holding the next Exhibition; such decision, however, shall be in accordance with the provision of the Rule adopted at the Annual Meeting of the Fair, 1858.

8. The Treasurer shall take charge of and duly account for all moneys advanced by the Government for the benefit of Agriculture, all subscriptions and donations made to the Association by Counties, Townships, Cities, Towns or Societies; all funds arising from the sale of Member's Badges or Tickets, and for entrance at the gates, and otherwise, entering the same under their respective heads in his general account; shall pay all accounts and expenses under instructions of the Council. The payment of premiums, and of all authorized contingent expenses of the Exhibition, shall be made so far as practicable on the spot where the same is held.

9th. The Treasurer and Secretaries, under approval of the Council, shall employ a proper number of experienced assistants in their several offices, so as to secure the most prompt and perfect despatch of business; and, with due regard to economy, there shall be employed such a number of constables and ticket receivers as shall be necessary for the best accommodation of the public, and for keeping order and protecting the articles in every department of the Exhibition.

10. The Treasurer shall make up and close the accounts of the Association, upon the 31st December of each year, attaching thereto a list of all claims unpaid; and the Council shall direct the same to be audited and published. All balances of cash and all other monies received on behalf of the Association, shall be placed to the credit of the same in such Bank as the Council may from time to time direct.

11. All stores and properties, of whatever kind, belonging to the Association and used for exhibition purposes, shall be in charge of the Treasurer; and he shall have the same properly protected and cared for from year to year, and shall have such as may be required conveyed to the place where the Exhibition shall be held.

12. The Local Committee may appoint a Chairman, and such Sub-Committees as may be deemed necessary, and shall assist the Council of the Association in every thing concerning which their assistance may be necessary in relation to the Annual Exhibition.

13. The Council of the Association may appoint General Superintendents of the several Departments, and also, so far as necessary, competent persons may be placed in charge of each class, who shall see that every possible facility is afforded to the Judges in the examination of the same.

14. A sufficient number of Refreshment Booths may be leased under direction of the Council, within the exhibition grounds, and shall be so constructed as to afford suitable accommodation to the public, and so as to secure the due maintenance of sobriety and good order; and any infringement of this regulation shall subject the offender to a forfeiture of his lease and the consideration paid therefor, and the Booth may be immediately closed by order of the President of the Association.

15. The Members of the Agricultural and Horticultural Societies of the cities, towns and townships, and the Members of the Electoral Division Societies within the Electoral Division in which the Exhibition may be held, or immediately contiguous thereto, shall be Members of the Association and shall have free entrance to the Exhibition for that year; provided that the said Societies shall each devote their whole funds for the year, including the government grant, in aid of the Association; provided also that the sum paid shall be not less than one dollar for each Member of the said Societies.

16. Upon the discovery of any fraud, deception, or dishonest practice, either in the preparation, ownership, or of any representation concerning any article exhibited, which may have affected, or have been intended to affect, the decision of the Judges, the Council shall have power to withhold the payment of any prize awarded, and may prohibit any such party or parties from exhibiting in any class for one or more years, and may also publish the names of such, or not, as may be deemed most expedient.

17. No Member of the Council or of the Local Committee shall be concerned in any contract or work of profit, directly or indirectly, ordered to be performed for the use of the Association, either as principal or surety.

18. These Rules may be altered or amended at any annual meeting of the Association; notice of the intended alteration or amendment being published in the *Agriculturist* and in the *Journal of the Board of Arts and Manufactures*, for three months prior to the day of the annual meeting, when the same shall be decided by a vote of two-thirds of the Directors present.

Toronto, 22nd September, 1862.

THE PROVINCIAL EXHIBITION.

THE PRIZE LIST.

In the next issue of the Journal we shall give the corrected Prize List for the Arts and Manufactures departments, with some comments of the judges contained in their reports on the various articles submitted to their decision. It is probable that the reasons which may then be assigned for the awards in particular instances will be appreciated by competitors and the public.

COPIES OF THE JANUARY No. WANTED.

A few numbers of the Journal for the month of January, of the present year, were sent to parties who were not then subscribers, but who subsequently became so, and then received a full set from the commencement of the volume—any such person having duplicate copies of the January No. preserved, would confer a favor by returning one copy to the Secretary of the Board.

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE DURING THE MONTH.

SHELF NO.		
J. 26	Annual Retrospect of Engineering and Architecture; a Record of progress in the Science of Civil, Military and Naval construction. 12 mo., vol. I, 1862	*G. R. Burnell.*
E. 32 & 33.	English Cyclopœdia of Art and Sciences. 4to., vols. 7 & 8, 1861—being completion of the work	*Chas. Knight.*
L. 20	Ure's Philosophy of Manufactures; an Exposition of the Scientific, Moral and Commercial Economy of the Factory System of Great Britain. 12 mo., 1861	*P. L. Simmonds.*
I. 49	Proceedings of the Literary and Philosophical Society of Manchester. 8vo., 1860-61 and 1861-62	
H. 45	Memoirs of the Literary and Philosophical Society of Manchester. 8vo., vol. I, 3rd series, 1862	
	The "Exchange:" a Home and Colonial Monthly Review of Commerce, Manufactures and Ghneral Politics	

N.B.—In future numbers of this Journal each new book enumerated as being added to the Library will have placed before it a number indicating its position in the Library for the convenience of reference.

BRITISH PUBLICATIONS FOR AUGUST.

	£	s.	d.	
Albert the Good; a Nation's Tribute of affection to his memory, 4to	0	18	0	*J. F. Shaw.*
Alevs (James de) Buddhism: its Origin, History, and Doctrines	0	6	0	*Williams and N.*
Ansted (Prof. D. T.) Short Trip in Hungary and Transylv. in the Spring of 1862, p. 8vo	0	8	6	*W. H. Allen.*
Arnold (Rev. Frederick) Public Life of Lord Macaulay, 8vo	0	14	0	*Tinsley.*
Brown (Wm.) Natural History of the Salmon, fcap. 8vo	0	2	6	*A. Hall.*
Davy (John) On some important Diseases of the Army	0	15	0	*Williams and N.*
De Quincy (Thos.) Works, new edit., Vol. 8, Leaders in Literature, &c., p. 8vo	0	4	6	*Black.*
De Witt (C.) Jefferson and the American Democracy, trans. by R. S. H. Church, 8vo	0	14	0	*Longman.*
Edmonds (Rich.) Land's End District; its Antiquities, Natural History &c. 8vo	0	7	6	*J. R. Smith.*
Francatelli (C. Elmè) Royal English and Foreign Confectioner, illust. p. 8vo	0	12	0	*Chapman and H.*
Gawthrop's Elocutionary and Rhetorical Class-Book, 2nd edit., by Davenport 12 mo	0	2	0	*Refle*
Gile's Keys to the Classics. Sallust's War of Cataline, 18 mo	0	1	6	*Cornish.*
Gosch (Charles A.) Denmark and Germany since 1815, 8vo	0	10	6	*Murray.*
Johnson (C. P.) Useful Plants of Great Britain, illust. by J. E. Sowerby, roy. 8vo	1	16	0	*Kent.*
Kirkaldy (David) Inquiry into the Tensile Strength of Wrought-Iron and Steel 8vo	0	18	0	*Simpkin.*
Little Book (A) for Every Man who Keeps a Horse, by L.L.D., fcap. 8vo	0	1	0	*Simpkin.*
My Country: the History of the British Isles, by E. S. A., 2 vols. 18mo	0	6	6	*Wertheim.*
Owen (Prof.) On the Extent and Aims of a National Museum of Natural History, 8vo	0	6	0	*Saunders & O.*
Ponting (T, Cadby) Photographic Difficulties; how to Surmount Them, &c., cr. 8vo	0	2	6	*Bland and Co.*
Rattray (A.) Vancouver Island and British Columbia, where and what they are, &c., p. 8vo	0	5	0	*Smith and Elder.*
Sandby (Wm.) History of the Royal Academy of Arts, 2 vols 8vo	1	10	0	*Longman.*
Simple Questions and Sanitary Facts, for the Use of the Poor, fcap. 8vo	0	2	0	*Tweedie.*
Thompson (Wm.) Practical Treatise on the Cultivation of the Grape Vine, 8vo	0	5	0	*Blackwoods.*
Tourrier (J.) Ten Thousand Useful French Words, Classed in Chapters, 12mo	0	3	0	*Nutt.*

Notices of Books.

The Annual Retrospect of Engineering and Architecture, a record of Progress in the Science of Civil, Military, and Naval Construction. *Vol. I., January to December*, 1861. *Edited by George R. Burnell, C.E., F. G. S.. London : Lockwood & Co*., 1862, *pp*. 359, 8*vo*.

This publication contains notices of the improvements which have taken place in many departments of mechanical science during the past year. It also embraces some valuable articles on different engineering works now in progress or recently completed. The contents of the first volume are devoted to Railways and Roads ; Harbours, Docks and Canals ; Gas, Water Supply and Sewerage ; Agricultural Engineering, Mechanical Engineering, &c., &c.; Architecture, Styles and Design and Practical Architecture. There is also a division devoted to Military and Naval Engineering, Steam Engines, Propellers, &c. As an interesting record, this retrospect will become valuable. The absence of a general index at the close of the volume is a great omission.

Proceedings of Societies.

VISIT OF HIS EXCELLENCY THE GOVERNOR GENERAL TO THE TORONTO MECHANICS' INSTITUTE.

On Wednesday of the Provincial Exhibition week, Lord Monck made a very interesting visit to the Mechanics' Institute of this city.

His Excellency arrived at the Institute a little after six o'clock in the evening, and was met at the door by Mr. W. Edwards, 1st Vice-President, and Mr. Walter S. Lee, 2nd Vice President, to whom he was introduced by his Worship the Mayor, and was by them conducted to the Music Hall, where he was enthusiastically received by a large company of ladies and gentlemen who had assembled for the occasion. Upon the platform, besides His Excellency and suite, and His Worship the Mayor, were the Directors of the Institute. Mr. Edwards informed His Excellency that in the absence of the President, Mr. Rice Lewis, it devolved upon him to read the following

Address

To His Excellency the Right Hon Charles Stanley Viscount Monck, Governor General, &c., &c.

"May it Please Your Excellency,

"We the Board of Directors of the Toronto Mechanics' Institute, on behalf of the members, anxious to do homage upon all proper occasions to our beloved Sovereign the Queen, desire to embrace this the first opportunity of doing so through Your Excellency as Her Representative in this important part of the Empire.

"We hail with pleasure Your Excellency's visit to this our city, offering as it does to all classes of Her Majesty's subjects an opportunity of expressing their loyalty and fidelity to their gracious Queen, more particularly as Your Excellency has been so recently appointed to represent Her crown and person in this Province.

"The Toronto Mechanics' Institute cannot fail to perceive in Your Excellency the patron of Literature, the Arts and Sciences, and are confident that Your Excellency feels so great an interest in all that tends to elevate the mechanic and working man as to look upon this and all similar Institutions with encouragement.

"We are satisfied that Your Excellency will be pleased to learn that from an humble beginning made by a few progressive citizens in the year 1830, the Institute has gone on increasing and prospering until it has become possessed of this building, [in which we have now the honour of receiving you] together with a library numbering over 5,000 volumes, a Reading Room which is the resort of our citizens generally, and other advantages open to the enjoyment of about one thousand members.

"While supplying reading matter to a large number of our citizens at a nominal charge, the Institute also affords means of instruction in the various branches of knowledge, which, while informing the mind and expanding the intellect, tends to the development of that mental and moral vigor so conducive to the greatness and happiness of a nation.

"In conclusion, we ardently express our hope that your Excellency's administration may be as prosperous and happy as its advent has been acceptable, and that both yourself and Lady Monck may recur to it in after life with that satisfaction which can only be derived from the remembrance of a well fulfilled mission."

His Excellency replied as follows ;—

"*To the Board of Directors of the Toronto Mechanics' Institute:*

"Gentlemen,—The expressions which I have just heard of loyalty to the Queen, and of courteous welcome to myself personally, demand my warm acknowledgments.

"I am, indeed, most anxious to do every thing which lies in my power to promote those praiseworthy objects that you have in view.

"The labouring classes in this country have every inducement to profit by the facilities of improvement that you offer them. They have but to look around and they can see many persons who began life with nothing to trust to but their own abilities, now holding distinguished positions in society, honoured and respected by all. Self culture is almost indispensable to the attainment of such a position, and therefore those who offer the means of it to persons desiring to profit by them, are engaged in a most useful work.

"I shall always have great pleasure in hearing that the Mechanics' Institute of Toronto is in a flourishing and satisfactory condition."

The following Directors of the Institute were then introduced to His Excellency by Mr. Edwards

who shook each heartily by the hand: Mr. John Paterson, (Treasurer) Messrs C. W. Bunting, J. J. Withrow, John Cowan, H. E. Clarke, W. H. Sheppard, Wm. Hamilton, jun., Wm. Halley, R. J. Griffith, D. G. Carnegie and H. Langley. Three cheers were then proposed by Mr. Edwards for the Queen, three for Lord Monck, and three for Lady Monck and family, all of which were heartily given.

His Excellency was then conducted through the Reading Room, the Library, and the Lecture Room with which he expressed himself much pleased, and regretted that time would not allow him to visit the other portions of their Noble Building. He then left amid renewed cheering.

ADDRESS FROM THE HAMILTON MECHANICS' INSTITUTE TO THE GOVERNOR GENERAL.

On the day of His Excellency's visit to the City of Hamilton, on the 18th ultimo, the following address from the Mechanic's Institute of that City was presented to him, in the large Hall of the Institute :—

To His Excellency the Right Hon. Charles Stanley, Viscount Monck, Governor General, &c, &c, &c.

May it Please Your Excellency:

We, the President and Directors of the Hamilton and Gore Mechanic's Institute, as well for ourselves as in the name of our constituents, beg to welcome your Excellency on this the occasion of your first visit to this city, for apart from the eminent qualities which you possess and which have rendered you worthy of the excellent position which you occupy, we recognize in you the representative of our beloved Queen, who is illustrious among the sovereigns of the civilized nations as a promoter of the arts and sciences, and an encourager of all that tends intellectually or morally to the good of her subjects. While thus tendering a respectful and a sincere welcome to your Excellency, we feel that we have great reason to congratulate ourselves, for we, whose duties are to encourage intellectual pursuits, to diffuse useful knowledge, and so to endeavour to refine the tastes of our fellow men, are confident that your Excellency will acknowledge the propriety of countenancing our efforts, and of giving to us and to similar institutions in the Province all the encouragement in your power.

Permit us to express the hope that your administration of the Government of the Province may be prosperous, and that you may experience much happiness in Canada, so that should your Excellency at some future time revert to your residence amongst us, your recollection of Canadians may not be tinged with regret.

Frederick James Rastrick, *President.*
Thos. M. Simmons, *Secretary.*

Hamilton, 16th. Sept., 1862.

[reply.]

To the President and Directors of the Hamilton and Gore Mechanic's Institute.

Gentlemen:—It affords me much pleasure to receive an address from a body associated together for such a praiseworthy object as is yours, and I thank you heartily for the kind greeting you offer me on my arrival in this city.

An institution whose aim is to refine and elevate the tastes of the people, and which endeavours to show them that the human mind has wants and aspirations which require something more to satisfy them than mere material prosperity, while it also supplies the needs it indicates, is deserving everywhere of the countenance of thoughtful men. And more especially is such a society useful and deserving of all encouragement in a country of comparatively recent settlement, where men are necessarily more universally engrossed with pecuniary cares and the needful provision for their families, than in a state of society where a larger leisured class exists, which has more time, means and opportunity to devote to intellectual cultivation, and to the promotion of science and art, than as yet is possible amongst any considerable portion of the population here.

Your exertions, gentlemen, will tend to keep moral and intellectual progress on a par with that material progress of which I see so many evidences, and so I bid you God speed, and wish you every success in your labours.

THE TORONTO MECHANICS' INSTITUTE, AND EVENING CLASSES.

The Board of Directors of this Institution have determined to establish during the ensuing season classes for instruction in English, French, German, Mathematics, Mechanical Drawing, Music, and Book-keeping with Penmanship. We are informed by the Secretary that the Institute has been very successful in getting good teachers; we may therefore look forward to much being done this winter in the way of middle class education. We hope the members will fully appreciate the advantages they enjoy, and that each class will be well supported. The terms are as follows :—

		Members.	Non-Mem.
English	Class............	$2 00	$3 00
French............	"	3 00	5 00
German	"	3 00	5 00
Mathematical...	"	2 00	3 00
Mechl. Drawing	"	2 00	3 00
Music	"	2 00	3 00
Book-keeping and Penmanship		2 00	3 00

Each class will be continued for a term of twenty weeks, two lessons each week, from 8 to 10 p.m.

Patent Laws and Inventions.

ABRIDGED SPECIFICATIONS OF ENGLISH PATENTS.

243. G. and G. Phillips. *Improvements in the distillation and rectification of alcohols or spirits.* Dated Jan. 30, 1862.

This consists in the filtration of the vapour of alcohol or spirit by passing it through wire gauze, perforated sheets of metal shavings, filings, or pellets of metal, fibres of silk, cotton, wool, &c., arranged so as to have fine openings or passages

through which the vapour of alcohol can pass, but not its impurities.

354. W. Macnab. *Improvements in steam engines.* Dated Feb. 11, 1862.

The patentee claims: 1. The causing of the fresh steam in combined high and low pressure engines to give up a portion of its heat to the partly-used steam, substantially as described. 2. The combining together of two pairs of high and low pressure cylinders, with the individuals of each pair acting at right angles, as described.

384. T. Davison. *Improved means for preventing the corroding of steam boilers.* Feb. 13, 1862.

This consists in introducing into the water a salt or salts, such as the carbonate of soda, potash, or lime, capable of neutralising the corrosive action of the injurious agent present in the water.

435. C. T. Marzetti and J. Watson. *Machinery or apparatus for raising, lowering, and otherwise moving or disposing casks and other heavy bodies.* Dated Feb. 19, 1862.

This consists in using a tangent wheel and screw, or worm and worm-wheel movement, in combination with a winding barrel or shaft, upon which is wound the chain or rope, to the one end of which the cask or other body, or the object to be raised, is attached by a sling and hook or other means, whereby a considerable economy both of labour and space is effected.

460. R. H. Skellern. *An improved self-inking hand-stamp or press.* Dated Feb. 21, 1862.

This invention comprises various improvements (the details of which we cannot here give space to) in that class of hand-stamp or press consisting of two side frames mounted together at or near the top yb a cross piece, through which slides vertically a hollow plunger, which is raised by a spiral spring in the interior.

461. H. Ward. *An improvement or improvements in ladies' saddles.* Dated Eeb. 21, 1862.

The patentee claims making the third or leaping crutch of ladies' saddles movable, without detaching it from the saddle, so that it may be adjusted and fixed to suit the convenience of the rider.

471. W. H. Ross. *Improvements in the manufacture of sugar.* (A communication.) Feb. 22, 1862.

This consists principally in using, in the manufacturing or refining of sugar, the phosphates of ammonia in conjunction with sulphurous acid, either gas or liquid, or with any of the sulphates or bisulphates.

472. J. Kirkwood. *Improvements in looms for weaving.* Dated Feb. 22, 1862.

This comprises various improvements in looms, the object being to admit of the application of steam or other mechanical power, and in one modification of loom embodying them are combined with jacquard pattern mechanism of the single lift class.

473. A. Bornemann. *Improvements in the mode of constructing fountains.* Dated Eeb. 22, 1862.

This relates to fountains adapted not only for pleasure grounds, but for drawing-rooms conservatories, &c., and consists in constructing such fountains so as to work by atmospheric pressure, without the aid of clockwork or other mechanism for producing and maintaining the requisite pressure.

Canadian Items.

PETROLEUM GAS—STEVENSON HOUSE.

The Toronto *Globe* of October 3rd, contains the following card from Mr. E. W. Stevenson, the proprietor of the Stevenson House, St. Catharines: —

Thomson's Patent Petroleum Gas Works.

Stevenson House, St. Catharines, C.W.,
Sept. 26th, 1862.

I have much pleasure in giving public testimony to the excellence, cheapness, and freedom from all kinds of annoyance from smoke or smell of the Petroleum Gas, made at my establishment, in the Patented Works erected by Mr. James E. Thomson. The works have now been in operation for six weeks, and have given uniform satisfaction in every respect. They supply my establishment, the Stevenson House, St. Catharines, C. W., with 180 burners, at a cost of 86 cents a night.

I most cordially recommend Thomson's Petroleum Gas to the general public.

(Signed,) E. W. Stevenson.

To James E. Thomson, Toronto and Buffalo.

This is a most satisfactory testimonial respecting the extraordinary cheapness, purity, and excellence of Petroleum gas. The importance of the new process for gas illumination will soon be appreciated, when such establishments as the Stevenson House find it economical and agreeable. It seems almost incredible that one hundred and eighty burners can be fed for the trifling sum of eighty-six cents a night. Under the old system of burning coal gas, one hnndred and eighty burners lighted on an average four hours per diem, and burning three feet an hour, would consume 2,160 feet of gas, which, at $2 50 a thousand, would cost $5 40 per night. The difference in favour of Petroleum gas, according to Mr. Stevenson's statement, is four dollars fifty-four cents, or upwards of $1,600 a year. Where four feet burners were formerly used with coal gas, instead of the one foot burner with Petroleum gas, and assuming that the average time of the gas being lighted at 5 hours a day, the saving is proportionately greater. When the works at the Rossin House are completed, which will be at the close of this month, the citizens of Toronto will have an opportunity of daily witnessing this beautiful light, and satisfying themselves by personal inspection of its extraordinary cheapness, brilliancy and purity.

"THE OIL SPRINGS CHRONICLE"—OIL SPRINGS.

This is the title of a paper which is published by Messrs. Edwin T. Solis and Hudson, at the new village of Oil Springs, in the county of Lambton, C. W. A couple of years ago, the township of

Enniskillen was a forest wild. It now contains several villages, among which is "Oil Springs," already a thriving little town, not two years old. The Oil Springs *Chronicle* looks as if it has seen at least a dozen years, and enjoyed a wide-spread and well-earned reputation. It has already reached, not its twenty-fifth year, or month, but its twenty-fifth week. Two pages and a half are filled with advertisements chiefly from Oil Springs, a village of yesterday, and Wyoming, the station on the Great Western Railroad, which is situated about a dozen miles from Oil Springs. We find advertisements of hotels, livery stables, houses, stores, goods, &c., just as if the site of Oil Springs was that of an old settled and well established city, and did not recollect being nothing but a forest two or three years ago, where one might find the track of a deer, or come across a wild turkey in a morning's stroll. The *Oil Springs Chronicle* will be invaluable to all who are interested in Petroleum, and it will likewise be of much service to those who have lands or other property in the Western District. We should be glad to see a list of wells dug in the Oil regions, an authentic enumeration of the natural springs which have been discovered, and an enumeration of the flowing wells with their history. No doubt there are many parties at Oil Springs who could furnish this information, it would be acceptable and valuable in many ways.

THE APHIS AVENÆ.

The *Canadian Naturalist and Geologist* for August contains a very useful paper from the pen of Dr. George Lawson, of Kingston, on the Aphis, which has been a source of such wide-spread alarm among the farmers of Upper Canada during the present and preceding year.

Dr. Lawson states that the Aphis Avenæ had not been recognized as belonging to the insect depredations already described as affecting grain crops in America until 1861. Notices of the insect will be found under the following synonyms: *Aphis Granaria*, Kirby; and Fitch, in the Country Gentleman, Albany, N.Y., Aug. 16, 1861; *Aphis Hordei*; *Aphis Cerealis*. This American species of Aphis is identical with the European species as determined by Mr. Walker of the British Museum, to whom Dr. Lawson sent some specimens; and also by Dr. Asa Fitch of Salem, Mass., who is satisfied that our Canadian Aphis is of the same species as the well known *Aphis Avenæ* of Europe. We give Dr. Lawson's description of this insect in his own words:

The insect is individually minute, like all the Aphides, but presents a formidable appearance on account of the vastness of its numbers. In some fields, a few days after its first appearance, the ears of grain became covered with it; in fact the wheat was commonly spoken as "dark with it." The fly presented itself chiefly in the wingless form, the individuals clustering in great numbers in the upper parts of the culms and panicles of wheat, rye, oats and barley, and this season they have been observed on indian corn and various other grasses. Most of them are stationary, but some are usually moving about with rather an awkward motion, resembling that of mites under a magnifying glass. On each panicle or head of grain they are found to be of various sizes, according to age, some scarcely large enough to be visible to the naked eye, others as large as the capital letters on this printed page. They vary in colour; some are pale apple-green, some of a brownish yellow colour and many, especially the older and larger ones are of a rather deep brick-red colour, when they become very conspicuous. In some cases where the whole ears were covered with the insects, the total destruction of the crops seemed to some of the farmers to be inevitable. They looked upon the "new bug plague" (for anything that looks like an insect is called a bug) as the greatest calamity that had ever befallen our fields. It was deemed advisable therefore to publish in the Kingston newspapers an account of the habits of the insect with the view of allaying unnecessary fears. Attention was drawn to the following among other facts;—The aphides do not gnaw the plant's stem and leaves like young caterpillars, nor like the midge, injuriously affect the young grain, but simply suck the juices of the most exposed parts of the plant. The plant necessarily suffers from this injury, its energies are weakened, the leaves and other parts shrivel and blister, and an inroad is formed for other diseases; but, while aphides are highly injurious to thin and succulent leaved plants the compact tissue of wheat and other grains, hardened too by silica, is not so liable to suffer and become deformed, and a vigorous healthy crop of grain will hardly be injured. No doubt the yield is lessened by the presence of the insect in vast numbers, and the quality of the grain perhaps slightly deteriorated, but the injurious effects are by no means so extensive as the formidable appearance of the insect would indicate.

During the present season (1862) the aphis has again made its appearance, and in as great numbers as before. It has naturally attracted less notice, but appears to be widely diffused in all the cultivated parts of central Canada. In August, 1862, I traced it from Kingston, on the scattered farms along the Addington Road, back to the township of Olden, a distance of about 50 miles. When we consider that many of the farms referred to are mere isolated patches of clearing in the woods, widely separated from each other, in some cases by miles of interminable forest and swamp, we see that the distribution of this insect is totally independent of its own limited locomotive powers. In its winged state it is no doubt carried in clouds by

the winds, like the seeds of thistles and other winged plants.

Mr. Walker calls attention to the fact that the aphis has many insect and other enemies in Europe, and in Canada it also has its enemies which during the past two seasons have been busily at work lessening its numbers. These have been so graphically depicted by Dr. Fitch, in the Albany Country Gentlemen, that I cite his description :—"On many of the wheat heads may at present be noticed from from one to half a dozen of these lice, which are very large, plump and swollen, of the colour of brown paper, standing in a posture so perfectly natural you suppose that they are alive. Touch them with a point of a pin, you will find that they are dead. Pick off a part of their brittle skin; you see there is inside a white maggot, doubled together like a ball. Put one of these wheat heads in a vial, closing its mouth with a wad of cotton. In a week's time or less, you find running actively about in the vial, some little black flies like small ants. These you see have come out from the dead lice through a circular opening which has been cut in their backs. Drive one or two of these flies into another vial, and introduce to them a wheat having some fresh lice. See how the fly runs about among them examining them with its antennæ. Having found one adapted to his wants, watch how dexterously it curves its body forward under its breast, bringing the tip before its face, as if to take aim with its sting. There, the aphis gives a shrug, the fly has pricked it with its sting an egg has been lodged under its skin, from which will grow a maggot like that first seen inside of the dead swollen aphis. And thus the little fly runs busily around among the lice on the wheat heads, stinging one after another, till it exhausts its stock of eggs, a hundred probably or more, thus ensuring the death of that number of lice. And of its progeny, fifty we may suppose to be females by which five thousand more will be destroyed. We thus see what effectual agents these parasites are in subduing the insect on which they prey. I find three different species of them now at work in our fields destroying this grain aphis. I have not space here to describe them. A particular account of them will be given in my Report in the forthcoming volume of Transactions of our State Agricultural Society. And aiding these parasites in the work which they have been created to perform, are several other insects to which I can only briefly allude. A lady bug or Coccinella (*C 9-notata*, Herbst) a pretty little beetle, nearly the size and shape of a half pea, of a bright yellow or red colour, with nine small black spots, has all the season been common in our grain field, it and its larvæ feeding on this aphis. Another insect of the same kind, but much smaller and black, with ten yellow dots on its wing covers, (*Brachyacantha 10-pustulata*, Melsheimer,) is little less common. The Chrosopa, or Goldeneye flies, are also there, placing their white eggs at the summit of slender threads that their young may feed on these lice. The lavæ of different Syrphus flies, small worms shaped like leeches, may also be seen on the grain heads, reaching about as an elephant does with his trunk, till an aphis is found, which is thereupon immediately seized and pulled from its foothold and devoured."

Photography.

THE USES OF PHOTOGRAPHY.

The *North British Review* contains an excellent *resumé* of the progress of Photography from the pen of Sir David Brewster. The following extract will be interesting to all admirers of this wonderful art; which is even yet in its infancy—

Importance to the Naturalist.

"The importance of photography in enabling the naturalist to represent with accuracy the various forms of animal and vegetable life cannot be too highly appreciated, both in its relations to art and to education- When we consider the vast number of species in zoology the noble forms of animated nature, whether wild or domesticated, and the services which many of them perform as the slaves of man, we can hardly attach too much importance to their accurate delineation. The Landseers, Copes, Andsdells, and Rosa Bonheurs of the present day give us fine delineations of the deer, the cattle, the dogs, the horses, and other animals which are associated with the wants and amusements of man; but even fine art might derive some advantage from their truthful photographs whether in plane perspective or in solid relief. When we look at the pictures with which Buffon has caricatured the world of instinct, we long to possess genuine representations of the giraffe, the lion, the tiger, the elephant, the gorilla, and the other noble animals which we see only in prison and in chains. With a truthful camera and an instantaneous process, the denizens of the jungle and the fields might be taken captive in their finest attitudes and their most restless moods; and binocular photographs thus obtained, and raised into relief, would furnish valuable ideas to the painters and the poets, whose works or whose epics may require an introduction to the brutes that perish.'

"The engraver has endeavoured to copy and perpetuate the finest productions of the pencil and the chisel; and the traveller, in his hurried sketches, has still more imperfectly represented to us the edifices of ancient and modern civilization. But the sun has outstripped them both; and though he has as yet only one colour on his palette, he exhibits on his canvas every visible point and line in his subject, and every variety of light, shadow and lustre, which the hour of the day or the state of the weather may impress upon it."

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Importance to the Sculptor.

"To the sculptor sun-painting is still more valuable. The living subject affords him little choice of material. Swathed in opaque drapery, the human figure mocks his eager eye, and it is only by stolen glances, or during angel visits, that he can see those divine forms which it is his business to perpetuate. He must therefore quit his home, and spend months and years in the museums of foreign art, copying day after day those master triumphs of genius which have been consecrated by the taste of ages. Brought back to his own studio, these copies will be his principal instructors. They will exhibit to him forms more than human, though human still, embodying all that is true and

beautiful in what might be man. These copies, however have a limited value. The light of the sun, even in a cloudless sky, is ever varying, and the breadth and direction of the shadows are changing from hour to hour. The portion of the drawing executed in the morning will not harmonize with what is delineated at noon or in the evening; and hence the most skilful representation of a piece of sculpture cannot possibly exhibit those lights and shadows which can give even an approximate idea of figures in relief. The binocular photographs, on the other hand, when rightly taken, give all the shadows of an instant of time, and when combined in the stereoscope, reproduce the statue in relief in all its aspects, and with all its parts as exhibited under the same beam of light."

Importance to the Engineer.

"To the engineer and the machinist, photography and the stereoscope are of inestimable value. The difficulty of drawing complex machinery is often insurmountable; and even when the drawings are well executed, it is not easy to study from them the construction and mode of operation of the machine; but the union of one or two binocular pictures of it, judiciously taken, will in many cases remove the difficulty both of drawing and understanding it. In the erection of public buildings, hourly and daily photograph have shown to the absent superintendent the progress of his work."

Importance in Microscopical Research.

"Photography has also been applied to the miscroscope, in reducing for special purposes, large objects into such small dimentions that they are invisible to the naked eye, and can be seen only in the microscope. Mr. Shadbolt seems to have been the first (March 1854) who executed these small photographs, by making an achromatic object-glass 1 or $1\frac{1}{2}$ inch focus the lens of a camera, and using a *structureless collodion*. His photographs of single persons varied from the $\frac{1}{20}$th to the $\frac{1}{40}$th of an inch, and could bear a magnifying power of a hundred times. The finest microscopic photographs which we have seen are those of Mr. Dancer of Manchester, consisting of single portraits, monumental inscriptions, and family and other groups.

One of them, a family group, contains *seven* full-length portraits, occupying a space the size of a pin's head, so that ten thousand single portraits could be included in a square inch! In 1857, the writer of this article, who took several of these to Rome, proposed to M. Castellani, the celebrated jeweller there, to have them placed in the centre of a brooch, a locket, or a ring, and magnified by the single or the central jewel, cut into lens sufficient to exhibit the group distinctly when looked into or held up to the light. It was also suggested to a distinguished diplomatist, that copies of dispatches might be transmitted by post, of words placed in spaces not larger than a full stop or a small blot of ink."

"Among the wonderful applications of photography, we cannot avoid mentioning one by M. Crusco, who in May 1859, presented to the Academy of Sciences a photograph of a morbid alteration in the choroid coat of the human eye, as seen in the ophthalmoscope, to which he has the name of *partial* atrophy. The photograph shows that a large portion of the choroid wants both the vessels and the pigment, and the sclerotic coat is seen, through it. M. Cusco has obtained many other photographs of intra-ocular lesions, both in the living and the dead subject."

Defect of Photography.

"The greatest defect of photography, as an art is, that its pictures are more perishable than the material which bears them. Many of them, indeed, have disappeared, and left the paper on which they were drawn in all its original whiteness. This fading of photographs has been ascribed, and we believe justly, to the imperfect removal by hot or cold water of the hyposulphite of soda used in fixing them; and for a long time photographers have endeavoured to get rid of this injurious salt. It is fortunate, however, for the credit of the art, that a method of reviving faded photographs has been discovered, and the following process has been published by MM. Davanne and Girard:—'Place the print in a solution of chloride of gold, and leave it in this bath for three or four hours if shielded from the light, or for a few minutes if under the influence of the solar rays. In other respects follow the ordinary course, pass through hyposulphite of soda, and *the print, however faded*, will be revived.'"

Cartes-de-Visite.

"Among the interesting applications of photography, we must mention one which we believe was first introduced at Nice by M. Ferrier in 1857. The Duke of Parma having had his full length portrait placed upon his visiting cards, some gentlemen imitated his example, which was soon afterwards followed in Paris and in London. In order to produce these *carte-de-visite* portraits quicker, a Parisian artist is said to have fitted up a camera with 24 lenses to take 24 negatives upon the same plate. These pictures will represent the party as seen from 24 different points of view. All *carte-de visite* portraits should be taken with binocular camera, and so as to show different distances, in order that those who chose it might obtain pairs for their stereoscopes. These portraits are, beyond doubt superior to all others, especially if taken, as they should be, at the distance of 20 or 30 feet, in which case they may be enlarged into a life size by the camera of Woodward, or other analogons instruments."

"From the history which we have now given, in this and in a previous article, of photography, and its processes and applications, the reader cannot fail to see that, notwithstanding the beauty of the Daguerrotype, the *Talbotype*, or photograph on paper, or its equivalents, is the true type of the photogenic art. The public have not yet suitably acknowledged the obligations which they owe to Mr. Talbot, who, in order to perfect the processes of his invention, has drawn liberally upon his fortune, and foregone for a while, a reputation of no ordinary kind, which his mathematical, physical, and literary accomplishments could not fail to have secured him. A jury of his country, indeed (the highest arbitrator of scientific contentions, in a court where Mammon presides), have decided that he is the inventor of the Talbotype; and we trust the day is not distant when the nation shall not grudge some honourable recognition of labours which

have given the professional bread to thousands—an elegant pursuit to hundreds of amateurs, male and female—domestic gratification to the occupants of the cottage and the palace—new powers of observation and research to the philosopher—and ever-flowing fountains of knowledge to every class of society but the blind. As James Watt was not the sole inventor of the steam-engine, nor Newton the sole discoverer of the laws of the planetary system, so Mr. Talbot does not claim to be the sole inventor of photography as an art or a science. Wedgwood and Davy were humble pioneers in guiding the pencil of the sun, and Niepce and Archer have added to its power; and if we may name any other individual in England as the great inventor of photogenic instruments and processes, we are sure that every photographer in the empire will not grudge this tribute of praise to Mr. Claudet, who has so long occupied the highest place in the profession."

PHOTOGRAPHIC NOTES.

Photography at the Great Exhibition.

Colonel Sir Henry James, Director of the Ordnance Survey, shows specimens of a very valuable adaptation of the art, by which the Government saves many thousands a year in the operations of his department, in the reduction, enlarging, and printing of maps and plans. It is termed "Photozincography," and the results are extremely beautiful and interesting. Sir Henry shows adaptations of it to the production of fac-similes of ancient MS.; and one of a page of Domesday Book is shown. The photograph by a simple and cheap process, is transferred to a zinc plate, whence any number of copies can be taken off by the ordinary plate printing press.

F. Joubert exhibits a series of very beautiful pictures burnt in on glass, a marvellous adaptation of the photographic art in an absolutely new direction; and here permanency is obtained, at least so long as the glass will last. By a pure photographic process he produces on the glass, in ceramic colours, a picture which by exposure to heat in the furnace becomes burnt in like any other picture on glass or china. By a careful and artistic manipulation he has been able to produce effects in several colours. The process has been perfected, and a cheap and artistic ornamentation of our windows, whether in portraits of our friends, landscapes of familiar scenes, architectural objects, or statuary, is brought within the means of the many.

Preserving Sensitive Paper.

M. Herm. Krone, speaking at the French Society of the Preservation of sensitive paper, states that it is necessary not merely that the paper should be kept dry and free from the action of the light, but that a certain amount of free chlorine should be present in the preservative cases to convert the particles of silver into chloride. For this, recent chloride of calcium alone is not sufficient. He recommends the followine mixture:—

Chloride of Calcium	3 parts,
" Lime	1 part.

The latter, continually exhaling gaseous chlorine, acts chemically; and the former, absorbing all moisture, keeps the paper dry.

Filtering strong Acids or Acid Solutions.

Guncotton is recommended by Bottger for filtering strong acids. He has used it with advantage for nitric acid, fuming sulphuric acid, chromic acid, permanganate of potash, aqua regia, &c.

M. Disderi's Formulæ.

M. Disderi, who is known as the most able and enterprising of Parisian photographers, has recently published a treatise on the art, in which he communicates the formulæ he has found most useful in practice. A quality in the collodion on which he lays great stress is the fact that it will remain humid a considerable time in either winter or summer, thus allowing for re-posing or re-arranging when the plate is in the dark slide, without injuring the film, which will retain its sensitiveness for an hour in winter, and a third of that time in summer. The formulæ are as follows. For winter operation he gives three recipes:—

Alcohol of 820 sp. gr.	400
Ether of 725 sp. gr.	600
Pyroxyline	11
Iodide of ammonium	6
Iodide of cadmium	4
Bromide of ammonium	0·6
Bromide of cadmium	0.4
Iodine	0·5

OR,

Alcohol 820 sp. gr.	400
Ether 725 sp. gr.	600
Pyroxyline	11
Iodide of ammonium	5
Iodide of potassium	5
Bromide of ammonium	1
Bromide of potassium	1
Iodine	0·5

OR,

Alcohol at 820 sp. gr.	400
Ether 725 sp. gr.	600
Pyroxyline	11
Iodide of ammonium	6
Iodide of cadmium	4
Bromide of ammonium	1·5
Bromide of cadmium	0·5

The two first are very vigorous, but are not distinguished by delicacy; the third gives very soft, delicate results. The first is best suited for a strong light, the second for an indifferent light, and the third for a weak light; the whole are intended to be used with a strong bath, as much as 48 grs. to the ounce being recommended. For spring operations he recommends the following formulæ:—

Alcohol of 820 sp. gr.	500
Ether of 725 sp. gr.	500
Pyroxyline	10
Iodide of ammonium	5
Iodide of cadmium	5
Bromide of ammonium	1
Bromide of cadmium	1
Iodine	0·5

OR,

Alcohol of 820 sp. gr.	500
Ether of 725 sp. gr.	500
Pyroxyline	10
Iodide of ammonium	5
Iodide of cadmium	5
Bromide of ammonium	0·5
Bromide of potassium	0·5
Iodine	0·5

A silver bath of from 35 grs. to 40 grs. is recommended for these collodions. For hot summer weather he gives the following:—

Alcohol at 52°	400
Ether at 62°	600
Pyroxyline	8
Iodide of ammonium	5
Iodide of cadmium	3
Bromide of ammonium	0·5
Bromide of cadmium	0·2
Iodine	0·3

With this a 30-grain bath is recommended.

Protosulphate of iron, 20 grains to the ounce, with 20 minims ef acetic acid, or pyrogallic acid 4 grains, and 4 minims of acetic acid, may be used for development. Flat negatives he strengthens with the following solution,—

Water	2 oz.
Bichloride of mercury	3 grs.
Hydrochloric acid	6 "
Chloride of gold	1 "

—*The Photographic Journal.*

Selected Articles.

THE MICHIGAN SALT WORKS.*

The existence of salt springs in the lower peninsula of Michigan has been known from the time of its earliest settlement, and when in 1836 the State was admitted into the Union, the privilege was granted her of selecting 72 sections of salt spring lands. In the following year she organized a geological survey, principally for the purpose of ascertaining the number and distribution of the salt springs in the State. This survey led to erroneous conclusions, and the borings for salt which followed these conclusions were unsuccessful.

In 1859 a second survey was commeneed and this led to the discovery and announcement, for the first time, that below the carboniferous limestone of Michigan occurs a series, 180 feet thick, of argilaceous shales, clays, magnesian limestones, and beds of gypsum; and that here is truly the origin of the brine. The strike of the outcropping edges of these strata describes an irregular circle, inclosing all the central portion of the State. The Michigan salt group of rocks underlies 17,000 square miles, in the form of a vast reservoir, constituting the most magnificent saliferous basin on the continent. The edges are sufficiently elevated to prevent the efflux of water which finds its way into it, and hence the saline particles have never been washed away. Beneath this series of shales is a porous sandstone—the Napoleon sandstone—which, within the circumference of the basin, becomes saturated with brine from above. From the nature of the case, it is evident that the strongest brine must accumulate in the deepest part of the basin.

Under this more intelligent guidance new borings were commenced and a well at East Saginaw reached the solid rock at the depth of 92 feet, and after passing through the coal measures, with their terminal and initial sandstones, pierced the carboniferous limestone, and found the Michigan salt group of strata 169 feet thick and eminently saliferous. In the Napoleon sandstone beneath, 109 feet thick, the reservoir of the brine was struck, and a supply, abundant in quantity, and of 90° strength, was obtained at almost exactly the point which geology had predicted. This well was 669 feet deep, terminating near the middle of the sandstone. Another was subsequently bored, 806 feet deep, extending through the sandstone and penetrating the underlying shales 64 feet.

This decided success was attained early in 1860. By July of that year a "block" had been erected and boiling commenced. Before the close of the year 4,000 barrels of salt had been manufactured, and no less than four other companies had commenced boring at different points along the river.

The following analyses will exhibit the strength and purity of Saginaw brines in comparison with those of other salt-producing regions:—

	Saginaw City.	East Saginaw.	Bay City.	Syracuse N. Y.	Kanawha, Va.
Specific Gravity	1·180	1·170	1·163	1·142	1·073
Chloride of Sodium	19·246	17·912	19·692	17·690	7·309
Chloride of Calcium	2·395	2·142	0·742	0·156	1·526
Chlo'de of Magnesium	1·804	1·522	0·432	0·119	0·374
Sulphate of Lime	0·534	0·116	0·155	0·573	——
Sulphate of Soda	——	——	0.116	——	——
Compounds of Iron	0·064	0·105	——	0·002	——
Other constituents	0·127	0·220	0·013	——	——
Total solid matter in 100 parts	24·170	22·017	21·140	18·540	9·209

As pure saturated brine has a specific gravity of 1·205, and contains 25·7 per cent of saline matter, it appears that the Saginaw brines approximate remarkably near to saturation.

The following table exhibits further comparisons:

Localities.	Weight of one gall. of brine.	Solid matter in one gall.	Pure salt in one gall.	Galls. required for 1 bus salt.
Saginaw City, lbs.	9·858	2·38	1·90	29
East Saginaw	9·775	2 15	1·75	32
Bay City	9·716	1 95	1·82	31
Syracuse	9.541	1·76	1·68	33
Kanawha	9·464	0·94	0·75	75

An intelligent writer in *Hunt's Merchants' Magazine* for September, to whom we are indebted for these interesting facts, states:—

It is now but two years since the first salt was manufactured in Saginaw valley; yet it is estimated that in this time the value of real estate has increased to the extent of three and a half millions of dollars in the counties of Bay and Saginaw. At Carrolton, grounds suitable for salt lots, which, two years ago were bought at $20 an acre, are now held at $300 and $400 per acre. At Saginaw city, salt lands have risen from $30 to $200 and $300 an acre. Wood lands, from one to eight miles west and north of Saginaw city, which, as late as 1861, sold for $15 and $20 per acre, are now selling for $40 and $45 per acre. At Bay city, the increased valuation has been similar. And this is but the first impression of the creation of this new branch of industry in what is generally regarded as a Michigan wilderness.

He also gives the following account of the processes of boring the wells and manufacturing the salt:—

In the boring of the wells of the Saginaw valley, steam power is always used, and the tools and details of the process are similar to those employed in Ohio and Virginia. The boring is generally done by contract. The price per foot two years ago was $3; at the present time it is $2, and I see no reason why the price should not be reduced to $1 50

* *Scientific American.*

per foot for wells not over 900 feet deep, since the engine—the only costly part of a well-borer's outfit—is furnished by the employer. The well is bored of an enlarged diameter, and tubed as far as the "bed rock." Beyond this, a diameter of 3½ to 5 inches is the usual capacity. On the completion of the boring to the requisite depth, the hole is tubed with iron to some point below the place of influx of fresh water. This is generally the carboniferous limestone; and here some sort of packing is introduced around the tube for the purpose of shutting off communication between the inside and outside of the tube. The strong brine rises to within 5 or 10 feet of the surface, and sometimes overflows—in one instance rising in a tube as high as 17 feet. In all cases, however, a pump is introduced into the well for the purpose of securing an adequate supply.

The water is pumped at an expense of about three cents per barrel of salt, into vats or cisterns elevated about five feet, and having generally a capacity of 20×30 feet and 6 feet deep, holding consequently about 26,000 wine gallons each. Two of these vats are requisite for each block. In the cisterns, the water is allowed five or six days to settle—that is for the iron to be precipitated—a process which is generally facilitated by sprinkling in the brine a small quantity of limewater.

The kettles are arranged in two close parallel rows, and supported by walls of brick and stone, forming an arch with a longitudinal partition—or more properly two arches, in the mouths of which the fires are built. A chimney, from 50 to 100 feet high, rises at the back extremity of the arches, and thus the heat is made to pass under each kettle of the double series. The arches are inclosed in a house 120 feet by 40, or thereabouts, with a shed rnnning the whole length of each side, divided into large bins for the reception of the salt. At the Bay city works the bins occupy a separate building, into which the salt is wheeled and emptied. This arrangement permits an opening to run the whole length of the block on each side, for the admission of air to drive the steam from over the kettles.

After settling, the brine is conveyed into the boiling house in logs, which run along the arch above the kettles, resting on the middle wall which separates them; and from these logs supplies are drawn as needed, into the kettles.

It may be of interest to note that kettles are not mauufactured at Bay city, but by a firm recently from Chatham, Canada West.

The fuel employed is generally a mixture of hard and soft kinds, for prices varying from $1 31 to $1 50 per cord. Hard wood, consisting of maple, beech, hickory, ironwood and birch, is exclusively employed at the East Saginaw works, and costs, delivered, $1 75 per cord. One block, including the engine, consumes about six cords of hard wood, or six and a half cords mixed wood, in twenty-four hours.

The brine, of course, evaporates much the most rapidly in the front kettles, immediately over the fire. These have to be filled once in three to five hours, and the back ones once in fifteen to twenty-four hours. Settling pans are introduced into kettles just filled, for the purpose of receiving any impurities precipitated by the application of heat. Occasionally milk, blood, or some other animal substance is employed to promote the clearing of the brine. Generally, also, some skimming is needed; and the more when the brine is purified in the manner just mentioned. The contents of the kettles are reduced by boiling to one-fourth or one-fifth the original quantity, when the salt, crystallized and fallen to the bottom, is transferred to baskets supported over the kettles, where it is allowed to drain.

The baskets at first used were of the Syracuse pattern; but these being found too small, a new style, patented by a Michigan man, and of larger size, is now generally employed. These cost forty cents each.

The baskets of salt, when moderately drained, are emptied into the bins, where the salt lies fourteen days to complete the drainage.

In the meantime, the kettles are replenished with brine and the same process is repeated. After a kettle has been boiled down two, three or more times, the accumulation of bitterns needs to be thrown out. Some prefer to do this after every kettle full. The bitterns are thrown into a conduit which runs at a convenient distance, and are thus carried out of the block.

The work is thus prosecuted day and night for the period of two to five weeks—the boilers and firemen succeeding each other in relays every twelve hours. At the end of this time the rapid evaporation and great heat of the front kettles has caused an incrustation to be formed upon the bottom from one or two inches in thickness. This must be removed, or it acts as a false bottom, permitting an interval to form between it and the kettle, thus rendering the bottom of the kettle liable to be melted out. In the Syracuse works this crust contains so much gypsum as not to be readily soluble, and is picked out with iron tools, to the great danger to the kettles. In the Saginaw works the crust is almost pure salt, and is at once loosened and removed by the simple introduction of fresh water, which is obtained from a second set of logs introduced for the purpose. The fires are permitted to go down on Saturday night. During Sunday the arches cool. On Monday any needed repairs are attended to, and on Monday night the fires are rekindled.

The amount of salt produced in twenty-four hours from a block of a given number of kettles, varies with the strength of the brine, the state of the atmosphere, the quality of the fuel, and the attention of the firemen. At Portsmouth, in good summer weather, 40 barrels are made per day from 50 kettles.

The packing of the salt is done for three cents a barrel. The barrels used cost from twenty-four to twenty-six cents — the price varying with the quality. Elm barrels with pine heads are generally employed; but at some of the works pine is used exclusively, These barrels are manufactured in stave and barrel factories opening in the vicinity, and are admitted to be a superior article for salt packing. No objection exists against elm staves, provided they are cut narrow; otherwise they are somewhat liable to warp on exposure to the weather, and might in some cases endanger the package. The tidy appearance of the packages of Saginaw salt has everywhere recommended it to notice.

The solar manufacture is yet in its inception.

The East Saginaw Co. have 20 solar vats in operation; and the prospects of success in this method of manufacture are so great that 500 additional vats and covers have been constructed, making a total outlay in the coarse salt manfacture of $8,500. Five hundred barrels have been produced.

The method of boiling in kettles is evidently too primitive and wasteful of heat to be tolerated by an inventive people. Immense quantities of caloric are transmitted from the arches to the ground and entirely lost. In Chapin's method the heat is conducted in every direction only into the brine. If he could now devise some means to utilize the steam, the economy of caloric would be complete. In the opinion of the writer, steam pipes might be made to replace the two flues in the condensing vat, and fuel employed—but in redoubled amount—only in the graining vat. We wait with interest to learn whether Mr. Chapin's process is destined to turn the old potash kettles on their sides.

In the process of boiling in kettles, two firemen and two boilers are required for each block—the firemen relieving each other at intervals of 12 hours, as also the boilers. At some of the works it is in contemplation to let the boiling—which can be done for ten cents a barrel—the company furnishing the fuel. This method, while it would increase the quantity of salt produced, might somewhat endanger its excellence. Under the present arrangement, boilers are paid $1 75 per day, and firemen $1. The wages of an engineer are $1 50 per day, and of common hands $1.

(This process was illustrated on page 97 of the current value of *Scientific American.*)

The total amount of fine salt manufaclured in the Saginaw Valley up to the first of July of the current year, was nearly one hundred thousand barrels. At the present time, the number of blocks in actual operation is 22, with an aggregate of 1,187 kettles. Several of these blocks have started within a few days. There are besides, four or five new blocks just ready to go into operation, to say nothing of the three blocks nearly completed for evaporation, by the Kanawha and Chapin process. If the 22 blocks now in operation succeed in maintaining the standard of productiveness established by the old ones, they are turning out daily 1,210 barrels, which, making allowance for the check of winter amounts to 396,000 barrels or 1,980,000 bushels annually. This is not a calculation of what the Saginaw works are expected to do; it is what they are doing at this moment; and shows a growth at the end of two years from the production of the first bushel of salt, equal to that attained by the Onondaga salt works in 1834, at the end of 38 years from the time the salt springs passed under the superintendence of the State. But it is not necessary to pause here. Within thirty days, or by September 1st, not less than four additional blocks would come into operation, raising the daily production to 1,300 barrels, and the annual production to 468,000 barrels or 2,340,000 bushels—a result only reached by the Onondaga salt works less than twenty-five years ago.

The only question which remains, and one upon which the predicted growth of the manufacture must depend, is that which respects the quality of Saginaw salt. There is no corner on which our predictions rest with greater security. The appearance of a pile of Saginaw salt is that of driven snow glistening in the morning sun. The grain is coarse, clean, and angular; the taste purely saline and unexceptionable, and the weight is 58½ lbs. to the measured bushel. Letters and documents are in the hands of the manufacturers proving that the acceptance of Saginaw salt is such that the market is literally clamorous for an adequate supply. It would occupy too much space to make many citations. The Mechanics' Institute, of Chicago, the New York State Agricultural Society, (at Elmira), and the Mechanics' Association, of Utica, have severally awarded the salt of the East Srginaw Company their highest testimonials. Harvey Williams, Esq., one of the oldest and most extensive fish packers on the lakes, certifies: "My experience and observation lead me to the opinion that the salt manufactured by your company is purer, stronger, safer, and more economical for fishermen than the Syracuse fine salt." He also names several other parties who have used the salt for fish packing with the same results. In Detroit, this salt is ranked equal to any, and is very often called for in preference to Syracuse salt. The annual statement of the trade and commerce of Toledo, says: "We are led to the conclusion that eventually all the beef, pork, &c., packed west of Lake Erie, will be laid down in Saginaw salt." Dow, Quirk & Co., of Chicago, think Saginaw salt "superior to any that comes to this market." Large quantities of this salt are now sold in London, C. W., whence it is distributed through the province. St. Louis and Cincinnati also take large supplies, and the demand, at all these points, is far greater than can be furnished.

ON FORCE.

(*Concluded from page 248.*)

There is one other consideration connected with the permanence of our present terrestrial conditions, which is well worthy of our attention. Standing upon one of the London bridges, we observe the current of the Thames reversed, and the water poured upward twice a-day. The water thus moved, rubs against the river's bed and sides, and heat is the consequence of this friction. The heat thus generated is in part radiated into space, and then lost, as far as the earth is concerned. What is it that supplies this incessant loss? The earth's rotation. Let us look a little more closely at the matter. Imagine the moon fixed, and the earth turning like a wheel from west to east in its diurnal rotation. Suppose a high mountain on the earth's surface; on approaching the moon's meridian, that mountain is, as it were, laid hold of by the moon, and forms a kind of handle by which the earth is pulled more quickly round. But when the meridian is passed, the pull of the moon on the mountain would be in the opposite direction, it now tends to diminish the velocity of rotation as much as it previously augmented it; and thus the action of all fixed bodies in the earth's surface is neutralized. But suppose the mountain to lie always to the east of the moon's meridian, the pull then would be always exerted against the earth's rotation, the velocity of which would be diminished in a degree corresponding to the strength of the pull. The tidal wave occupies this position—it lies always to the east of the moon's meridian, and

thus the waters of the ocean are in part dragged as a brake along the surface of the earth; and as a brake they must diminish the velocity of the earth's rotation. The diminution though inevitable, is, however, too small to make itself felt within the period over which observations on the subject extend. Supposing, then, that we turn a mill by the action of the tide, and produce heat by the friction of the millstones; that heat has an origin totally different from the heat produced by another mill which is turned by a mountain stream. The former is produced at the expense of the earth's rotation; the latter at the expense of the sun's radiation.

The sun, by the act of vaporisation, lifts mechanically all the moisture out of the air. It condenses and falls in the form of rain,—it freezes and falls as snow. In this solid form it piles upon the Alpine heights, and furnishes materials for the glaciers of the Alps. But the sun again interposes, liberates the solidified liquid, and permits it to roll by gravity to the sea. The mechanical force of every river in the world, as it rolls towards the ocean, is drawn from the heat of the sun. No streamlet glides to a lower level without having been first lifted to the elevation from which it springs, by the mighty power of the sun. The energy of winds is also due entirely to the sun; but there is still another work which he performs, and his connection with which is not so obvious. Trees and vegetable grow upon the earth, and when burned they give rise to heat, and hence to mechanical energy. Whence is this power derived? You see this oxyd of iron, produced by the falling together of the atoms of iron and oxygen; here also is a transparent gas which you cannot now see —carbonic acid gas— which is formed by the falling together of carbon and oxygen. These atoms thus in close union resemble our lead weight while resting on the earth; but I can wind up the weight and prepare it for another fall, and so these atoms can be wound up, separate from each other, and thus enabled to repeat the process of combination. In the building of plants carbonic acid is the material from which the carbon of the plant is derived; and the solar beam is the agent which tears the atoms asunder, setting the oxygen free, and allowing the carbon to aggregate in the woody fibre. Let the solar rays fall upon a surface of sand; the sand is heated, and finally radiates away as much heat as it receives; let the same beams fall upon a forest, the quantity of heat given back is less than the forest receives, for the energy of a portion of the sunbeams is invested in building up the trees, in the manner indicated. Without the sun the reduction of carbonic acid cannot be effected and an amount of sunlight is consumed exactly equivalent to the molecular work done. Thus trees are formed; thus the cotton, on which Mr. Bazely discoursed lately, is formed. I ignite this cotton, and it flames; the oxygen again unites with its beloved carbon; but an amount of heat equal to that which you see produced by its combustion was sacrificed by the sun to form that bit of cotton.

But we cannot stop at vegetable life, for this is the source, mediate or immediate, of all animal life. The sun severs the carbon from its oxygen; the animal consumes the vegetable thus formed, and in its arteries a reunion of the severed elements takes place, and produces animal heat. Thus, strictly speaking, the process of building a vegetable is one of winding up; the process of building an animal is one of running down. The warmth of our bodies, and every mechanical energy which we exert, trace their lineage directly to the sun. The fight of a pair of pugilists, the motion of an army, or the lifting of his own body up mountain slopes by an Alpine climber, are all cases of mechanical energy drawn from the sun. Not, therefore, in the poetical, but in a purely mechanical sense, are we children of the sun. A man weighing 150 lbs. has sixty-four pounds of muscle; but these, when dried, reduce themselves to fifteen pounds. During an ordinary day's work, for eighty days, this mass of muscle would be wholly oxidised. Special organs which do more work would be more quickly oxidised: the heart, for example, if entirely unsustained, would be oxidised in about a week. Take the amount of heat due to the direct oxidation of a given amount of food; a less amount of heat is developed by this food in the working animal frame, and the missing quantity is the exact equivalent of the mechanical work which the body accomplishes.

I might extend these considerations; the work, indeed, is done to my hand—but I am warned that I have kept you already too long. To whom, then, are we indebted for the striking generalisations of this evening's discourse? All that I have laid before you is the work of a man of whom you have scarcely ever heard. All that I have brought before you has been taken from the labors of a German physician, named Mayer. Without external stimulus, and pursuing his profession as town physician in Heilbronn, this man was the first to raise the conception of the interaction of natural forces to clearness in his own mind. And yet he is scarcely ever heard of in scientific lectures, and even to scientific men his merits are but partially known. Led by his own beautiful researches, and quite independent of Mayer, Mr. Joule published his first paper on the "Mechanical Value of Heat," in 1843; but in 1842 Mayer had actually calculated the mechanical equivalent of heat. In 1845 he published his Memoir on "Organic Motion," and applied the mechanical theory of heat in the most fearless and precise manner to vital processes. He also embraced the other natural agents in his chain of conversation. In 1853 Mr. Waterston proposed, independently, the metoric theory of the sun's heat, and in 1854, professor William Thomson applied his admirable mathematical powers to the development of the theory; but six years previously, the subject had been handled in a masterly manner by Mayer, and all that I have said on this subject has been derived from him. When we consider the circumstances of Mayer's life, and the period at which he wrote, we cannot fail to be struck with astonishment at what he has accomplished. Here was a man of genius working in silence, animated solely by a love of his subject, and arriving at the most important results, some time in advance of those whose lives were entirely devoted to Natural Philosophy. It was the accident of bleeding of a feverish patient at Java in 1840, that led Mayer to speculate on these subjects. He noticed that the venous blood in the tropics was of a much brighter red than in colder latitudes, and his reasoning on this fact led him into the labora-

tory of natural forces, where he has worked with such signal ability and success. Well, you will desire to know what has become of this man. His mind gave way; he became insane, and he was sent to a lunatic asylum. In a biographical dictionary of his country it is stated that he died there; but this is incorrect. He recovered; and, I believe, is at this moment a cultivator of vineyards in Heilbronn.

While preparing for publication my last course of lectures on Heat, I wished to make myself acquainted with all that Mayer had done in connection with this subject. I accordingly wrote to two gentlemen who above all others seemed likely to give me the information which I needed. Both of them are Germans, and both particularly distinguished in connection with the Dynamical Theory of Heat. Each of them kindly furnished me with the list of Mayer's publications, and one of them was so friendly as to order them from a bookseller, and to send them to me. This friend, in reply to my first letter regarding Mayer, stated his belief that I should not find anything very important in Mayer's writings; but before forwarding the memoirs to me he read them himself. His letter accompanying the first of these papers, contains the following words:—"I must here retract the statement in my last letter, that you would not find much matter of importance in Mayer's writings: I am astonished at the multitude of beautiful and correct thoughts which they contain;" and he goes on to point out various important subjects, in the treatment of which Mayer had anticipated other eminent writers. My second friend, in whose own publications the name of Mayer repeatedly occurs, and whose papers containing these references were translated some years ago by myself, was, on the 10th of last month, unacquainted with the thoughtful and beautiful essay of Mayer's, entitled "Beitrage zur Dynamik des Himmels;" and in 1854, when Professor William Thomson developed in so striking a manner the meteoric theory of the sun's heat, he was not aware of the existence of that essay, though from a recent number in *Macmillan's Magazine* I infer that he is now aware of it. Mayer's physiological writings have been referred to by physiologists—by Dr. Carpenter, for example—in terms of honourable recognition. We have hitherto, indeed, obtained fragmentary glimpses of the man, partly from physicists and partly from physiologists; but his total merit has never yet been recognised as it assuredly would have been had he chosen a happier mode of publication. I do not think a greater disservice could be done to a man of science, than to overstate his claims; such overstatement is sure to recoil to the disadvantage of him in whose interest it is made. But when Mayer's opportunities, achievements, and fate are taken into account, I do not think that I shall be deeply blamed for attempting to place him in that honourable position which I believe to be his due.

Here, however, are the titles of Mayer's papers, the perusal of which will correct any error of judgment into which I may have fallen regarding their author. "Bemerkungen über die Kräfte der umbelebten Natur," Liebig's Annalen, 1842, vol. 42, p. 231; "Die Organische Bewegung in ihrem Zusammenhange mit dem Stoffwechsel;" Heilbronn, 1845; "Beitrage zur Dynamik des Himmels," Heilbronn, 1848; "Bemerkungen über des Mechanische Equivalent der Warme," Heilbronn, 1851.

INDIA RUBBER MANUFACTURES AT THE INTERNATIONAL EXHIBITION.

(*From the "Mechanics Magazine."*)

"To commence with our own country, and the Eastern Annexe, to which india-rubber manufactures—like many others, equally worthy of better positions in the main building—have been condemned, we find upwards of twenty exhibitors of various manufactures in this material, to say nothing at present of gutta-percha, and other analogous substances.

"Prominent amongst these stand the original patentees in England, C. Macintosh and Company, of Manchester, who have three cases here, containing specimens as applied to various purposes. The manufactures of this firm are too generally known to need much comment; but we may particularize, as worthy of notice, the beautiful specimens of raw material in their large case, showing the process of manufacture, from the masticated lump to the finished sheet. They also exhibit suction hose, buffers and springs, driving bands, tubing of all colours, and a peculiar make of hose, consisting of leather and india-rubber combined, which, we should think, for some purposes, an improvement on the ordinary kind. They have, also, an application of tubing for the illumination of railway carriages by gas, which, we understand, has been tested on the Lancashire and Yorkshire Railway, and found practicable. This being the case, we sincerely hope that its adoption will be universal in *every class* of railway carriage, as well as on all lines. In educational appliances, an inflated globe for the use of schools merits attention, as a very simple and cheap substitute, and decided improvement on "*the use of the globes.*" The one exhibited is about three yards in circumference, the price being only £3 10s.

"Next in importance are Messrs. Silver and Company, and Messrs. Warne and Company, who stand forward pre-eminently as enterprising producers of the newest improvements in the manufacture and application of the material. Silver and Co., with their ebonite, which is similar in appearance to the old vulcanite of 1851, stand by themselves; no one having hitherto been able to produce the material satisfactorily in this country. They exhibit, as practical applications, tubes or pipes of large dimensions, which are not effected by acids, for the use of vinegar and dye works; bottles and funnels, photographic baths and dishes, (in place of gutta-percha,) coated harness irons, bracelets and chains, for ornamental use in place of jet, as well as numerous other things. In soft vulcanized india-rubber, great credit is due for a very ingenious mat for doors or halls. This is produced by making incisions with a sharp knife at regular intervals and spaces in a sheet of the *un*vulcanized material, so that when stretched out small diamond squares are formed, and being kept open by mechanical means during vulcanization, a mat is produced, firm to the foot, and excellently adapted for the purposes required. They also exhibit washers, valves, steam packing, hose, &c., all of which show a great advance

in finish and quality. We have recently noticed the india-rubber insulated wire of this firm, as well as their ebonite pole-insulators, which will be found with other telegraph appliances, in Class 13.

"Messrs. Warne and Co. exhibit several very novel and useful appliances of the material. Their "junction rubber" for piston rings, pump buckets, &c., made of soft and hard rubber combined, is a very ingenions and valuable application, as also their "patent screw shaft " water-stop for ocean steamers, which prevents the necessity of stoppage for re-packing when at sea. This is effected by the inflation of two rings so arranged as to answer the end required, whilst the stuffing-box is being re-packed. They also show an elastic bath towel, having a rubber warp alternate with cotton; "red mineralised rubber;" "ferruginous " cement packing;" a very ingenious flesh brush, and their "aromatic bands," which are all worthy of notice as improved appliances of the material, as also an "Archimedean screw rifle cleaner." Messrs. Warne and Co. were the first to introduce the use of india-rubber for door-mats, samples of which they exhibit. These are formed of sections of tubes cemented together. They are well adapted to the purpose, and are extensively used. The whole contents of this case are well worthy the attention of our readers and the commercial public.

"On the opposite side, in the centre passage, will be noticed a very handsome case devoted to the exhibition of overshoes, hose, belting, &c., manufactured by the North British Rubber Company of Edinburg. This firm, which, we believe, consists chiefly of Americans, possesses the advantage of the superior knowledge attained in that country, where the india-rubber trade has been so much more extensively developed than in England, and, consequently, their goods at once strike the eye as superior to what we have seen elsewhere. This is shown particularly in their overshoes, which, indeed, is a branch of the trade that has hitherto only been carried on in France and America. The shoes exhibited here, however, very far exceed in beauty of make and finish those of either of the other makers. This is not only apparent in shoes, but in the other three articles to which their manufacture is confined—valves, hose, and belting. In front of their case, let into the floor, is the largest valve which has every been made, being 6 feet 4 inches in diameter, and 1½ inches thick, made of pure rubber, in the manufacture of which no solvent has been used. In their hose there is a clearness of finish which must place it in favourable contrast with other makers.

"India-rubber hose must eventually supersede leather, as being more durable and cleanly, and for fire-engines certainly possesses advantages from its smoothness of bore, and consequent non-resistance to the passage of the water. The same advantages are possessed by india-rubber belting for machinery, which is daily superseding the use of other kinds.

"The belting shown by the North British Company is of remarkable strength, and yet possesses a requisite amount of elasticity. Numbers of the machines in the Western Annexe are driven by these bands, as well as the pumps of the large French fountains in the Horticultural Gardens. In the same case are shown combs manufactured by another branch of the firm—the Scottish Vulcanite Company—which are very good specimens of the variety of patterns and shapes which may be produced in the material.

"Coming down the Annexe we find a cluster of smaller cases, each containing specimens of india-rubber manufactures. Chief amongst these we remark that of Messrs. P. B. Cow and Co., of Cheapside, which contains a most elegant collection and arrangement of useful appliances. Their water-proofed cloths, of every shade of colour and substance, are superior articles. Great care is evidently given to this branch of their trade, and their specimens deserve attention. Among other things they show a knapsack and haversack combined, which from its lightness, compactness, and general finish, would be invaluable to the tourist; also a ladies' yachting jacket, of fine but strong material, which must become an essential in the outfit, not only of yachting ladies, but all those who take long voyages. The floor of this case is covered with an inlaid pavement of hard rubber in various colours, which we should like to see tried practically in some position where its merits or defects could be ascertained. The effect is pleasing, and we should think, if not too expensive, the application is a good one.

"Mr. J. L. Hancock exhibits an ingenious "portable air-bed chair," for invalids which can be packed in a very small compass for travelling; Messrs. Tuck, their elastic steam packing; Mr. Wansbrough, his patent flocked cloth; Mr. Foster, of Streatham, various articles made from waste vulcanized rubber; Mr. Hodges, his excellent accumulators or springs; and Mr. Horsey, of Lambeth, a variety of small but useful articles for personal use.

"Mr. Hooper, of Pall Mall, and Messrs. Hall and Wells, exhibit specimens of their manufactures; the first in vulcanized sheet rubber, &c., and the latter in elastic braids and fabrics. Both these firms also exhibit, in Class 13, the application of india-rubber to the coating of telegraph wires for submarine and aerial purposes, as named in our recent article on telegraph apparatus. The india-rubber covered wires of Messrs. Hall and Wells exhibit excellent material and superior workmanship.

"Messrs. Spill and Co. have a large assortment of waterproof goods, as well as specimens of their vegetable leather made up in various forms. There are also several exhibitors of kamptulicon floor cloth, which is a compound of india-rubber and cork.

"Before leaving the Eastern Annexe there is one case to which we would draw the attention of those interested in the subject, and that is the one containing samples of "campticon, or india-rubber substitute," exhibited by Messrs. F. Walton and Co., of Chiswick. The high price which india-rubber has reached, and the greatly increased consumption, render the question of an economical substitute a great desideratum. The paper which was recently read before the Society of Arts by Mr. F. Walton, and which was published in the journal of that Society, very clearly describes the nature of the new material. It is made from oxidised oil, so treated as to remove all unctuous matter, and is formed into a semielastic resin, which for many purposes, such as steam packing, driving bands, and hose, is

said to answer equally as well as india-rubber at a considerable less cost. It can be supplied in either dough or solution, and as a hard compound vulcanizes as readily as india-rubber, without the use of sulphur. We shall hope to hear more of this invention, as we believe it will prove an important addition to the known elastic and waterproofing gums.

"The Gutta-Percha Company have a very good display of their general manufactures in this annexe, their insulated wires being with the other telegraphic apparatus within a short distance of their case. Mr. C. Hancock exhibits a large and extremely elegant sideboard, enriched with very beautiful mouldings in gutta-percha, which well deserves the attention of every visitor, showing, as it does, the adaptability of the material to such purposes. On the top is a well-executed model of a dog reclining on a roughly-shaped block of gutta-percha, the effect of which is extremely good. Passing into the main building, we find in the French Court several exhibitors of tubing and vulcanised rubber goods generally, and from Hanover three or four, two of which deserve more extended notice. These will be found in the south-western transept.

"Messrs. Cohen and Co., of Harburg, make the most extensive display of any one in the building, consisting of india-rubber goods generally—overshoes, clothing, tubing, toys, and a very elegant and useful mat or carpet for doors, stairs, railway carriages, &c. By the side of this case are shown specimens of india-rubber combs in great variety, made by the Gummi-Kamm Company, of Harburg. Close by these, in the centre of the transept, are three exhibitors from Prussia—Messrs. Blanke, of Magdeburg; Bolle and Co., Berlin; and Fanrobert and Reimann, also of Berlin; they do not, however, show anything specially worthy of notice, the general appearance of their goods having nothing to attract the eye, and being badly displayed, prevents the possibility of judging as to their quality.

"There is but one other stand to which we would draw attention, and that is the exhibition of the Russian India-Rubber Company, of St. Petersburg, which is placed in the north-west gallery, and we mention this only to draw attention to the fact we have before named, of the superiority of the manufacture when directed by American skill, the manager of this company being a gentleman who has had long experience in that country. They display overshoes, hose, and belting of very superior quality. Many of the boots are specially adapted to Russian wants, and we should think they must be thoroughly appreciated in their severe winters.

"The india-rubber trade is yet in its infancy; and the advances that have been made during the past ten years will, we feel assured, be far exceeded in the decennial period before our next international display. Ingenious and enterprising manufacturers will spring up,, who will improve and invent, adding to the many valuable appliances of the material which are daily made. We should not go so far as the late enterprising Charles Goodyear, who proposed to erect a house of hard india-rubber, but we see many things to which it may be applied with success, creating new and profitable industries, for our teeming population to replace those which in the course of time either die out or change their localities. And it is to these periodical exhibitions that we must look for the advance of thought and interchange of idea, which will tend eventually to bind all nations together in a firmer bond of brotherhood.

LAKE NYASSA.—CENTRAL AFRICA. *

River Shire, Jan. 6, 1862.

Having lately returned from the exploration of about 200 miles of Lake Nyassa, a few notes respecting this part of the Lake region of intertropical Africa may not be unacceptable to my fellow-members of the American Geographical and Statistical Society.

We carried a boat past the Murchison† cataracts of this river, in August last, a distance of 35 or 40 miles. In that place we have five considerable cataracts of 100 to 150 feet each; but the intermediate spaces are very rapid, too, as may be inferred by the total descent being 1,200 feet. When we launched the boat on the Upper Shire we were virtually on the lake, though 60 miles distant, for that part of the river partakes much of the character of a lake. It spreads out in one spot to a lakelet, 10 or 12 miles long, and 5 or 6 broad

On the 2nd of September we sailed into lake Nyassa, and found it to be very deep. Our means of sounding were very imperfect, we had brought a lead line of thirty-fathoms; failing to reach the bottom at a mile from the shore we employed a fishing line and found bottom in a bay at one hundred fathoms, or six hundred feet; but a mile outside of the bay we felt none with one hundred and sixteen fathoms, or six hundred and ninety-six feet. The water is cool in consequence of its large volume, and alligators (which, well fed on fish, seldom molest men) allowed us to bathe in its waters whenever we chose. This great luxury can be enjoyed in but few African rivers, and palisades are often made by the natives to protect women in drawing water against these dangerous reptiles. The shape of the lake is, with the help perhaps of a little imagination, somewhat like Italy on the map. The ankle of the boot is in the narrowest part about eighteen or twenty miles; that is if we exclude the arms of its southern end. One of these, 30 miles long and 10 or 12 broad, is prolonged into the Shire. The other, about the same breadth, is 18 miles long, and if we reject the boot shape, we may say that the southern end has a forked appearance. It expands up toward the north to fifty or sixty miles; the length is over two hundred miles, probably two hundred and twenty-five, but we failed to reach above the two hundred. It begins in latitude fourteen degrees twenty-five minutes south, and extends into the Southern borders of the tenth degree of South latitude. It lies between the 35th and 36th degrees east longitude, and is very nearly straight. We sailed along the western shore and found it to be a succession of bays all open to the east. We were there during the prevalence of equinoctial gales, and found that furious storms came down with great suddenness from the mountains and high lands with which Lake Nyassa is

* Communicated to the American Geographical and Statistical Society.

† So named after Sir Roderick Murchison, President of the Royal Geographical Society of London.

surrounded. Heavy seas in which no open boat could live often get up in fifteen or twenty minutes. There are several small rounded rocky islands covered with forests, which are uninhabited. These would afford no shelter to a ship, for many rocks put out from deep water near them; an anchorage is to be found only near the shore. Five rivers of fifteen to thirty yards flow into it from the west; possibly another of larger size flows in from the north, but that we did not see. The lake rises and falls about three feet between the wet and dry seasons; the water is fresh but somewhat earthy tasted and hard. The population on its shores is prodigiously large; all engage in catching fish by nets, hooks, creels, torches or poison. Slavery is the only trade they know. An Arab vessel called a dnow had lately been built on the lake to carry slaves across, and we daily expect a steamer (in parts) out from England to be carried past the cataracts, and launched on its waters for a very different purpose. The natives had never seen Europeans before, and we had to be stared at to any amount. They were upon the whole civil; no fines were levied or dues demanded. We were, however, robbed in the sphere of the slaves' operations; the first time we had suffered loss by thieves in Africa. The people are much less honest where slaving goes on than elsewhere, and there they place but little value on human life. We went up to show a mission (sent out by the Oxford and Cambridge Universities) a healthy locality on the islands south of Mount Zomba, and in trying to induce a tribe called Ajawa to desist from slave-hunting, were attacked with poisoned arrows and guns, and but for recourse to fire-arms in self-defence would soon have been made food for the vultures; they were the first who have attacked us in Africa, and seemed maddened by continued success in clever forays against their fellow country-men.

Africa is a continent of the future. It is impossible to recite its capabilities. It is preëminently a cotton country, for here the plant is perennial, and requires little of that heart breaking toil necessary where it is an exotic; no frosts endanger the crops, and the best qualities yield largely. Slave-hunting is the greatest drawback known—it depopulates the country so much that labor becomes dead in proportion to its prevalence. The Portuguese possessions on the Zambezi are valueless, because all the labor is departed to Bourbon, the subjects of his Most Faithful Majesty at Lisbon having performed the part of the boy of the Goose with the Golden Egg.

In addition to the missions of the English Universities two other missions in this region are contemplated. Healthy localities can be secured on the highlands, which arise on our east to a height of some 6,000 or 8,000 feet above the sea.

I am, &c.,

David Livingstone.

INUNDATION OF THE MARSHLAND FENS.

Where the Wash penetrates between the counties of Lincoln and Norfolk, and threatens even to advance into the great Levels of Cambridgeshire and Huntingdonshire, and even to the home county of the Duke of Bedford, great fortifications have been raised in far distant times, and are continued down to the present The works of the old monks are still to be seen, and our Sovereign Lord King Henry VIII., after he had driven these dammers out, by his Statute of Sewers, formally declared war against "the outrageous flowing surges and course of the sea in and upon marsh grounds and other low places." The Bedford Level was in itself an usurpation of half a million of acres, which were at least of an amphibious character. The traveller who knows these Fens, who has ridden along the straight roads, and experienced how often he has to go along three sides of a square to arrive at his destination, need not be told that Holland is not the only country of dams, and that the Dutch are not the only people who must hunt a rat in a dyke lest it should flood a province.

It is in this district, where he has met with such continuous defeat, that the watchful enemy has at length found a weak place. Freshes of flood water from the distant uplands have a natural tendency to linger and soak in these peaty levels; high spring tides have an inclination to flow over and not return. There are 700,000 acres of the most productive land in the kingdom which lie below the high-water level of the Wash and depend for their existence as land upon great embankments and self-acting sluice-gates. Four miles south of King's Lynn there is a sluice-gate through which the waters of one of the huge drains empty themselves at low water into the river Ouse, thus passing out to sea with the receding tide, the gates closing of their own accord to the pressure of the rising tide. These works were, unfortunately, allowed to fall into disrepair. Small symptoms of decay, eloquent to the initiated, were disregarded. The natural consequence followed. The German Ocean, with a high spring tide, came up the river and toppled down the defences. The waters have been ever since pouring through that gap. Every tide necessarily increases the breach. The letting out of waters is proverbially a folly difficult to be repaired. Day by day the floods creep on, covering farm after farm and homestead after homestead; swallowing up flocks and herds, and driving back yeoman families, who retreat from their relentless enemy, and retreat as paupers. With a few great exceptions this is a county of small proprietors:—"Cottagers have been driven at short notice from their homes, some moving their down-stairs furniture into the chambers, others being able to carry off most part of their moveables in carts, and house after house is to be seen with waves lapping at the brick walls and wetting the doorhandles, while hedge tops denote the site of the garden and its submerged vegetables. Where the flood is deepest the rows of pollard, willow, or thorn bushes, and the top bars of gates indicate where enclosures of cropping lie; and on the outskirts of the bright sheet of water you see fine wheat crops with their rank green flags, forward peas and beans, ridges where the potatoes were but lately planted, fallows half prepared for mangold and turnip-sowing—over all of which the water is stealthily creeping and killing all with its deep irrigation of brine." All efforts to arrest this steadily advancing enemy appear to have been hitherto vain. The "Middle Level Commissioners" have held consultations, but their collected wisdom has not frightened the invader; barges laden with clay bags have been

sunk in the current of the tide, but the tide has toppled them over, emptied them, and passed on. There is now, we are told, hardly any obstacle to prevent a steamboat going several miles up the cut and through the breach, and paddling about the Fens. The condition of the inhabitants, not only of the inundated territory, but also of the threatened districts, is terrible. To them the age of Deucalion and Pyrrha is come back again, and the portents of the Roman poets are realities. Competent authorities, so far from being able to give any consolation, declare that the district flooded at present is nothing like so great as the area which will in all probability suffer for the next year, or even more. Such is the present state of this vast and increasing irruption.—*Times.*

Since the above was written the progress of the sea has been arrested, and there is every probability that the submerged land will soon be re-claimed.

Miscellaneous.

VALUABLE RECEIPTS.

Black Japanning.—Black grounds for japans may be made by mixing ivory black with shellac varnish, or for coarse work, lamp black and the top coating of common seedlac varnish. A common black japan may be made by painting a piece of work with drying oil and putting said work into an oven not too hot, then gradually raising the heat and keeping it up for a long time, so as not to burn the oil and make it blister.

Tortoise Shell Japan.—This varnish is prepared by taking of good linseed oil one gallon and of umber half a pound, and boiling them together until the oil becomes very brown and thick, when they are strained through a cloth and boiled again until the composition is about the consistence of pitch, when it is fit for use. Having prepared this varnish, clean well the vessel that is to be varnished (japanned) and then lay vermillion mixed with shellac varnish, or with drying oil diluted with good turpentine, very thinly on the places intended to imitate the clear parts of the tortoise shell. When the vermillion is dry brush over the whole with the above umber varnish diluted to a due consistency with turpentine, and when it is set and firm, it must be put into an oven and undergo a strong heat for a long time. This is the ground for those beautiful tea-boards which are so much admired. The work is all the better to be finished in annealing oven.

Painting Japan Work.—The colours to be painted are tempered generally in oil, which should have at least one-fourth of its weight of Gum sanderac or mastic dissolved in it, and it should be well diluted with turpentine, that the colours may be laid on thin and evenly. In some instances it does well to put on water colors or grounds of gold, which a skillful hand can do and manage so as to make the work appear as if it were embossed. These water colors are best prepared by means of isinglass size mixed with honey or sugar candy. These colors when laid on must receive a number of upper coats of the varnish above described.

Cements for Joints of Petroleum stills.—Take 6 lbs. graphite (black lead), 3lbs. of dry slacked lime, 8lbs. of the sulphate of barytes and 3lbs. of boiled linseed oil, and mix them thoroughly together. The solid materials must be reduced to fine powder before being stirred among the linseed oil. If the above quantity of oil is not sufficient for making the cement sufficiently thin add more until the proper consistency is obtained.

Linseed meal cake reduced to powder and mixed with water so as to make it into a paste makes a good lute for stills which are not subjected to a temperature above 260° Fah.

Cement for Leaky House Roofs.—Take 4 pounds of Rosin, one pint of linseed oil, two ounces of red lead, and stir in pulverized sand until the proper consistency is secured, and apply it warm. This cement becomes hard and yet possesses considerable elasticity and it is durable and water proof.

Clear Gutta Percha Solution.—Cut gutta percha into thin strips and put it in a glass bottle, and add as much chloroform as makes a thick paste. This paste is then placed in very hot water and kneaded with the fingers. After considerable manipulation the gutta percha loses much of its color, and if this process is repeated, becomes very nearly colorless, having only a pale straw tint. A chloroform solution may then be made of any strength, which is useful for many purposes—when thin, as a substitute for court plaster, and when thick, as a stoping for decayed teeth.

To Remove Resin Spots from Silk.—Many silk dresses receive stains from turpentine being spilt upon them. These stains are due to the resin which is held in solution by the turpentine, and which remains in the silk after the volatile or spirituous portion has evaporated. Alcohol applied to the stains with a clean sponge will remove the spots because alcohol dissolves the resin. The silk stains should be moistened with the alcohol first, and allowed to remain soaked for a few minutes. Fresh alcohol is then applied with the sponge, and with a slight rubbing motion. It is then wiped as dry as possible and afterwards permitted to dry perfectly in the open air. Alcohol also removes grease and oil spots from silk and woollen dresses, but oil generally leaves a yellow stain behind. A mixture of alcohol and the refined light petroleum, called benzone, is excellent for cleaning light kid gloves, ribbons and silks. It is applied with a clean sponge. Persons who apply these liquids and mixtures to cleaning silks, gloves &c., must be careful to do so in an apartment where there is neither fire nor lamp burning, under the penalty of an explosion.—*Scientific American.*

Parchment Paper.

Ordinary water-leaf paper, as it is called, that is common white blotting-paper—says Dr. Lyon Playfair, F. R. S., Professor of Chemistry in Edinburgh :—for you know it better by that name,—is simply dipped into diluted sulphuric acid ; but the dilution must be exact. If you err on either side, even within very small limits of error, you get a waste product and not parchment paper. If your acid be too weak, you convert the paper into a gum ; and if the acid be too strong you corrode the paper, and do not get what you desire. In or-

der to produce this beautiful parchment-paper, you must take exactly two measures of strong oil of vitriol—sulphuric acid—and one measure of water, and mix them together. They first become heated, and you allow them to cool ; and after they have cooled to the ordinary temperature they are ready for use. Nothing is more simple. The best paper for this purpose is that which has been well pulped, or well disintegrated in the making. The conversion of it into parchment paper is an exceedingly simple operation. I now place it in ammonia, which takes away the acid, and there is the parchment paper completed, so that you see nothing is more easy. What have I done? Although I have effected such a transformation in the paper that it is now much stronger than it was before, yet we have added actually nothing to it. The acid has not entered into its composition. It is the same weight after it has dried as it was before. It is simply a molecular change which has occurred in the character of the paper, the pores of the water-leaf having become closed, and it is now repellant of water. It is a semi-transparent body with great elasticity. You can bend it backward and forward without cracking, and the strength of it is much increased. It is repellant of water, but it allows some fluids to pass by a process of diffusion ; and when it is stretched upon a sort of drum, or a sieve frame, or wooden circle, it forms an instrument, which, in the hands of the Master of the Mint, has produced that elegant process of separation, of diffusive analysis, which he has called "Dialysis." The strength of the paper is so much increased by this operation of simply subjecting it to the action of the acid, that a strip of paper which requires sixteen pounds weight to break it when it is in the state of the water-leaf, requires seventy-five pounds to break it after it is passed into the other state. This property of sulphuric acid with regard to paper was discovered in 1854 by Mr. Gaine ; but it was not until some years afterwards that Mr. De la Rue, by extensive experiments was enabled to form parchment paper as a commercial article, and it is now used for a great many purposes. There are some deeds written upon it. And it is now extensively used by ladies for covering preserve-jars, and is used for a great many other useful purposes.

Bank-Note Splitting.

Mr. Thomas Millard, a native of Bath, now one of the Queen's book-binders, under the librarian at Windsor Castle, has discovered a method of splitting bank notes or any other sheets of paper. By the courtesy of Mr. Gregory, of Bath Street, with whom Millard served his time as an apprentice, specimens of the young man's ingenuity, consisting of a 5*l.* Bank of England note, a sheet of the *Times*, of the *Illustrated London News*, of the *Bath Journal*, and of the *Daily Telegraph* each of which has been split cleanly and cleverly into two parts, without any rent or tear, have been exhibited to many of our fellow-citizens during the past week. There can be no mistake about the matter, as we have now before us a copy of a leaf of our own *Journal* completely split in two. The separate parts could well be printed on at the back, but the separation of the flimsy paper of the *Telegraph* seems equally complete. The engravings in the illustrated journal are brought out more clearly by the process, and when mounted on cardboard present a strikingly improved appearance. The discovery is applied by Mr. Millard to practical use in print-mounting, and in repairing torn leaves of books, which he can so skillfully manage that the junction of the new and old can with difficulty be distinguished. The mounting of old prints upon paper is also so complete, that the specimens we have seen seem impressed upon the original paper. Unscrupulous people would certainly turn this plan of bank-note splitting to profitable account, if they could find it out, inasmuch as the halves could be made as stiff as the whole, the blank parts could be printed in imitation of the original, and the water-mark would of course be perfect. A cotemporary says that "Mr. Millard has devised a method of manufacturing paper that cannot be split, and bankers will probably soon be compelled to make use of his invention?" but this we understand is a mistake. Mr, Millard, to prevent the difficulty which might arise to the bank of England for having their water mark left on blank pieces of paper, upon which might be printed *fac similes* of their notes, suggest a plan for the prevention of the fraud. We are glad to hear that Her Majesty, in consideration of the talent displayed by Mr. Millard in this discovery, has already been pleased to order that he should have an increased salary. We hope his discovery may further lead to his pecuniary advantage.—*Keene's Bath Journal.*

Porous Water-Proof Cloth.

This quality is given to cloth by simply passing it through a hot solution of weak glue and alum. This is what is done by paper makers to make writing paper, the very thing which constitutes the difference between it and blotting paper, only on cloth the nap like the fur of a beaver, will preserve the cloth from being wet through as the rain will not adhere but trickle off as soon as it falls, and moisture will not adhere at all.

To apply it to the cloth, make up a weak solution of glue and while it is hot add a piece of alum, about an ounce to two quarts, and then brush it over the surface of the cloth while it is hot, and it is afterwards dried. Cloth in pieces may be run through this solution and then wrung out of it and dried. By adding a few pieces of soap to the glue the cloth will feel much softer. Goods in pieces may be run through a tubful of weak glue, soap and alum, and squeezed between rollers. This would be a cheap and expeditious mode of preparing them. Woollen goods are prepared by brushing them with the above mixture, first in the inside, then with the grain or nap of the cloth, after which it is dried. It is best to dry this first in the air and then in a stove room at a low heat, but allow the cloth to remain for a considerable time to expel the moisture completely. This kind of cloth, while it is sufficiently waterproof to keep out moisture and rain—being quite impervious to water—is pervious to the air. Many fishermen know that by boiling their pants, jackets, nets and sails in a pot with oak bark and fish skins, and afterward drying them, they become waterproof. The composition mentioned above is of nearly the same nature as the fish glue and oak bark, and consequently the same effects are produced. The composition is stated to be improved by adding

about one-fourth the quantity of the sulphate of copper to the alum. Cloth made waterproof in this manner will resist the effects of water even if it is somewhat warm, but it loses its waterproof properties if boiled. Persons who are exposed to the inclemency of the weather, will find it to their advantage, as a means of perserving health to prepare their clothes in the way we have described. Several corps in the French army are provided with porous water-proof cloth tunics prepared in a similar manner. They have been found very beneficial when the troops are in active service.—*Sci. Amer.*

Subterranean Railway.

The Metropolitan (Subterranean Railway) Works were inspected in August by a party of the directors and other gentlemen interested in the undertaking, who passed through the entire length of the line from the junction at Paddington to within a few yards of the temporary station at Farringdon Street. The inspection commenced at the terminal station at Paddington, the construction of which is a difficult piece of work, arising from the confined and awkward nature of the ground on which the station has to be fitted on either side of the up and down lines of the metropolitan branch. At this point an artificial roadway is carried on girders to give room for a standing, and for an approach for cabs and omnibuses. The engine used on Monday was especially designed for the line by Mr. Fowler, the engineer of the company. It consumes its own smoke and condenses its own steam, and gives off neither smoke nor vapour when it once enters the tunnel. The carriages are lighted with gas on a simple and efficacious plan. In an india-rubber bag, on the roof of each carriage, the gas is inclosed, and feeds two lamps for two or three hours. This arrangement has been at work for some time on many of our northern lines and on the continent and has always worked with safety. When empty the bags are replenished in a few moments from an ordinary gas-stand pipe. The train proceeded at the rate of about twelve miles an hour — a speed that was seldom exceeded, from the constant stoppages to visit all the stations. The tunnel was perfectly clear, free from close air, dry, and well lit. The directors were perfectly satisfied with the result of their inspection. The line it is reported, will be open for traffic on the 1st of October.—*Mechanics Magazine.*

Mechanical Power of the Tides.

Let us suppose that by the action of the tides the difference of level of the surface of the ocean at a certain spot is 21 feet between high and low water; omitting for the present all consideration of the power of the subjacent liquid, what is the mechanical value of a space of 100 yards square of this water? 100 yards square by 21 feet deep equals 70,000 cubic yards of water, which is lifted to a height of 21 feet, or to 1,470,000 cubic yards lifted to a height of 1 foot. Now, since one cubic yard of water weighs about 1,683 lbs., 1,470,000 cubic yards weigh 2,474,010,000 lbs., which is lifted in six hours. This is equivalent to lifting a weight of 412,335,000 foot lbs. in one hour; and since one horse-power is considered equivalent in raising 1,800,000 foot lbs. per hour, we have, locked up in every 100 yards square of sea surface, a power equal to a 230 horse-power steam-engine, acting, be it remembered, day and night to the end of time, requiring no supervision, and costing nothing after the first outlay but the wear and tear of machinery.

Different Glazes used for Cooking Utensils.

The wrought and cast iron vessels which are to be placed on the fire are often covered with enamel, which protects the liquid from metalic contact with the sides.

Two compositions are generally employed for this purpose, one having for its base silicate of lead and the other boro-silicate of soda. These enamels are applied to the scoured surface of the metal in the form of a powder, which is fixed by heating it to a sufficiently high temperature to fuse it; it then spreads over and covers the metal with a vitreous varnish.

The boro-silicate of soda enamel possesses great superiority over that of silicate of lead, for it is unattacked by vinegar, marine salt, the greater number of acid or saline solutions, even when concentrated, and resists the action of the agents employed in cooking or chemical operations.

The silicate of lead enamel is whiter and more homogenious, which explains the preference given to it by the public; but it gives up oxide of lead to vinegar or to common salt; it acts upon a great number of colouring matters, and it is attacked by nitric acid, which immediately communicates a dull appearance to it. On evaporation the liquid leaves a white crystalline residue of nitrate of lead. This enamel is instantly darkened by dissolved sulphides, and also by cooking food containing sulpher, such as cabbage, fish, and stale eggs.

It is very easy to distinguish these two enamels by means of a solution of sulphide of potassium, sodium, or ammonium. On allowing a drop of one of these reagents to fall on the vessel to be tested, the lead enamel darkens in a few moments, whilst the boro-silicate of soda enamel retains its white colour.—*Journal d'Anvers.*

Silvering Solution.

If one drop of solution of acetate or sulphate of morphia (1 per cent. strength) be mixed with ten or fifteen drops of a solution of nitrate of silver (four grs. to the drachm), and agitated for a minute or so, a fine white crystalline precipitate of frosted silver shortly takes place, the liquor acquiring a slight yellow colour from the reaction of the liberated nitric acid upon the morphia, and on decantation or filtration and the addition of strong nitric acid the usual orange-red colour of morphia is developed. If a white porcelain dish, containing the nitrate of silver solution, be slightly warmed previons to adding the morphia, the reduction is almost instantaneous, and the vessel coated with a film of silver.

Aurora Borealis.

M. De la Rive has recently communicated to the *Philosophical Magazine* some researches on this phenomenon. The fundamental points established are:

1st. The coincidence of the occurrence of aurora in the northern and southern hemispheres, particularly at Christiania and Hobart Town.

2nd. That the phenomenon is an atmospheric one.

Alex. S. Macrae's Circular for September.

PETROLEUM, OR ROCK AND WELL OIL.—In my last circular it was intimated that owing to the high prices of rosin, the refiners of that article had turned their attention to the above oil. One very important feature has developed itself within the last few weeks, namely, the relative value of American and Canadian Crude.

It was generally predicated, before the eupion or benzine was utilized, that the American, possessing so much more of it than the Canadian would be of less value, although the latter *nauseated* consumers with its very offensive smell, but other results have accrued. Owing to spirits of turpentine having advanced to four times their average value, varnish and paint manufacturers have seriously studied the applicability of spirits of petroleum as a substitute, and I may safely say with the most perfect success in a majority of instances. The American Crude, therefore, as stated, being so much more replete with this than the Canadian, and being again so much more agreeable in smell has become first in favour, and, as I write, rules £2 per tun above the oil of our own colony. So long, therefore, as the American is plentiful, Canadian will be neglected; but should the former (as seems likely to be the case) become scarce and dear, a disparity in prices may reconcile the consumer to the latter. This detrimental prospect, however, does not apply to the distilled. Let the Canadians send the deoderised safe refined; the quality of some that has been sent over being superior or equal to anything yet manufactured.

I would remind the refiner, that the Government Bill, which becomes law on the 1*st proximo, permits the unlimited sale of an oil that is safe at* 100° *Fahrenheit and upwards, while it places the most rigid restrictions on qualities that are permanently ignitable under that range.*

The Petroleum Trade.

The last steamer from New York brought a circular of the American Petroleum or Rock Oil Company, which has been organized with a nominal capital of £100,000. The company offer to deliver it in any quantities free on board at New York, and they state that the Excise duty, equal to 7d sterling per gallon, recently imposed upon refined oil under the new system of Federal taxation, does not apply to exported oil, and that in that case there is no duty on the crude article. In addition to the qualities of this oil as an illuminator, giving a much whiter light than gas, as well as for purposes of lubrication, and for the manufacture of dyes, it is now found to yield a substitute for turpentine, which, so far as it has been tested as a vehicle for painting, is considered to work much more freely than turpentine, and to combine the properties of that spirit with some other peculiarity, which gives it fluency and softness. The consumption of rock oil in the world is vaguely estimated to have been 15 millions of gallons in 1860, and 20 millions in 1861, while for 1862 the quantity, it is thought, may range from 30 to 50 millions.—*London Times, Sept.* 19.

The New Main Sewers of London.

The aggregate length of the present sewers in the City of London is 2,000 miles. These are to be tapped on each side of the Thames by means of six immense tunnels 9 feet 6 inches in diameter, which will carry the sewage 26 miles from London before it is allowed to fall into the Thames. The cost of this gigantic enterprise is estimated at £4,000,000 sterling. The works will be large enough to carry off the sewage water of a city twice the size of London, or one containing six millions of people. Attempts will be made to apply the sewage as manure. The number of yards of concrete consumed on the south side of the river will be 800,000, of brick 300,000,000, and 4,000,000 cubic yards of earth work. The sewage will be pumped into reservoirs by eight pumps seven feet in diameter, and capable of raising 25,000,000 cubic feet in a day.

Green Colour which may be Employed in Confectionery.

The finest green colour is formed, as is known, from preparations of copper and arsenic; that of which the formula is here given is devoid of danger, and may replace it. To obtain it, infuse for twenty-four hours 0·32 grammes of saffron in 7 grammes of distilled water. Then take 0·26 grammes of carmine of indigo, and infuse it in the same manner in 15·6 grammes of distilled water. Then mix the two liquids together, and a very beautiful green colour is obtained, which may be employed for colouring an immense quantity of sweetmeats (10· parts of this solution will colour 1000 parts of sugar of a very beautiful green). This colour may be preserved for a long time, either by evaporating the liquid to dryness or by converting it into a syrup.—*Journal de Pharmacie et de Chemie*, xli. 286.

Phosphorescent Pork.

M. Hankel, in the *Annalen der Physik*, gives an account of the phenomenon of phosphorescence appearing on pork. The phosphorescence was silvery white, and enlightened the neighbouring objects. It was superficial; for, on cutting the flesh with a knife, the under part was obscured till after a certain time, when doubtless the oxygen of the air had had time to act. The phosphorescent matter was of an unctious character, and M. Hankel could not perceive in it any traces of organised beings. The light was annihilated by the application of ether, alcohol, a solution of caustic potash, cold, hot water, and a temperature of 104° F.; but in the last two cases the light reappeared when the flesh was restored to the ordinary temperature. The light also disappeared when placed in a vacuum, or in an atmosphere of carbonic acid; but returned when a little oxygen was permitted to enter. Sulphuric acid annihilated it for ever. Ozonised oxygen does not sensibly affect this phosphorescence. Fatty oils lessen its duration (this is the case also with distilled water); but none of these liquids become phosphorescent by contact with this animal matter. This phenomenon has been previously observed in sea-fish, at the time when they were on the verge of putrefaction, and has been called the "glow-worm fire." The same appearance is sometimes offered by rotting wood. It is not certain that in any of these cases the appearance is due to the oxidation of phosphorus. It would be important to learn whether the pork described by M. Hankel, is poisonous when "phosphorescent."—*Brit. Med. Jour.*

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

NOVEMBER, 1862.

PETROLEUM GAS.

The London *Times* roughly estimates that the quantity of Petroleum or Rock Oil which will be exported to Europe in 1863 will amount to fifty or sixty million gallons. Numerous uses for the different light and heavy oils, which can be procured from petroleum by distillation, are already known, and application is now made of this curious product in a great number of forms. But it is as an illuminator that it will find most favor with the public, where the supply is constant and cheap; and it is very probable that, as an economical source of gas for illuminating and heating purposes, it will rapidly come into general use.

The results of a series of experiments which have recently been made at the gas works from which the small towns of Homer and Courtland, in the State of New York, are supplied, are most satisfactory and encouraging, both with regard to the luminous qualities and the remarkable cheapness of petroleum gas.

The following details are the results of careful measurement in all particulars, from which information as to the economy of the manufacture of petroleum gas could be derived.

The process employed at Homer and Courtland is similar, in most respects, to that which enables the proprietor of the Stevenson House, St. Catharines, C.W., to light his establishment with 180 burners, at a cost of 86 cents a night, under what is known as Thomson's patent.

The retorts at Homer are two in number, and of the following dimensions:—

Length	$7\frac{1}{2}$	feet.
Breadth	16	inches.
Height	12	"

Two vertical tubes are cast on each retort for the purpose of supplying water and petroleum. The retorts are laid horizontally in an arch, exactly the same as ordinary coal gas retorts, for which they can be substituted without much trouble or expense. Each retort is divided into three chambers called the petroleum, the water and the coke chambers respectively.

Petroleum and water are introduced in continuous streams through the tubes before described, so that when once a barrel of petroleum is placed at a sufficient height to allow a pipe provided with a stop-cock to feed the retort, the fluid may be admitted and the process of conversion into gas goes on without further trouble, until the barrel is exhausted.

Two series of experiments were recently made at Homer, with the following results:—

FIRST TRIAL.

Quantity of gas made by each retort, per hour, 450 cubic feet.
Total quantity of gas made, 3,380 cubic feet.
Petroleum consumed, 38 wine gallons.
Condensed petroleum, capable of being used over again, 4 gallons.
Quantity of petroleum per 1,000 feet of gas, $10\frac{1}{17}$ gallons.
Time required to make 3,380 feet, 3 hours 45 min.
Time of heating the retorts; the same as for coal gas.
Quantity of fuel; same as for coal gas.

SECOND TRIAL.

	C. F.
Quantity of gas made by the two retorts in the first hour	1,080
Quantity of gas made in second hour, less 10 minutes	820
Proportionate quantity in second hour	984
Total quantity in two hours	2,064
Mean quantity per hour	1,032
" " for each retort per hour	516

Quantity of fuel; same as for coal gas.
Time of heating retorts; same as for coal gas.

Quantity of petroleum consumed	25	wine gals.
" condensed petroleum, capable of being used again	$1\frac{3}{4}$	"
Actual quantity of petroleum used	$23\frac{1}{4}$	"
Quantity per 1,000 feet	$11\frac{9}{15}$	"

MEAN OF THE TWO EXPERIMENTS.

Total quantity of gas made, 5,280 cubic feet.
Total time occupied in making the gas, 5 hours 35 minutes, or very nearly 1,000 feet per hour, or 500 feet for each retort.
Petroleum consumed; 11 gallons per 1,000 feet.

In the first hour of the second experiment, the quantity made was 1,080 cubic feet; and the condenser shewed that too much water was admitted, (about one-eighth of the whole quantity of petroleum.) This unnecessary quantity of water evidently cooled the retort, and prevented the gas from being formed so rapidly as during the first trial.

A one-foot burner, with this gas, gives as brilliant a light as a four-feet burner supplied with

common coal gas.* Hence, 1,000 feet of petroleum gas will go as far as 4,000 feet of ordinary coal gas for illuminating purposes.

Now, when we examine these results, and compare them with what has been done in the manufacture of coal gas, the following remarkable comparisons present themselves.

In making coal gas a charge of 150 lbs. of coal is generally introduced into the retort, and allowed to remain for five hours. It generates 600 feet of gas, if the coal is of moderately good quality. This is at the rate of 8,000 feet for 2,000 lbs., or one ton of coal. To produce 600 feet of gas, the destructive distillation has to be carried on for a period of five hours. In a retort of the same dimensions and heated in the same manner, no less than 2,500 cubic feet of petroleum gas are produced, under precisely similar conditions. But one cubic foot of petroleum gas is equal in illuminating power to 4 cubic feet of coal gas. Hence, in five hours the petroleum produces, when reduced to the equivalent of coal gas, the enormous quantity of 10,000 cubic feet of gas, against 600 by the coal process. The saving of fuel and labor is consequently enormous.

If we assume that the illuminating power of petroleum gas is only three times that of coal gas, the proportion of each kind produced in 5 hours is as follows:—

7,500 cubic feet of gas by the petroleum process.
600 " " by the coal process.

Hence, in this case, which is below the actual results, the GAIN IN TIME required for the manufacture of petroleum gas, as compared with coal gas, is as TWELVE to ONE. This fact alone reduces the number of retorts in petroleum gas works on a large scale, to at least, say, one-sixth of the number required for coal gas works. Actually one petroleum retort can produce the equivalent in gas of twelve coal gas retorts. When the annual expense of retorts is taken into consideration, this item alone establishes a great argument in favor of the petroleum process; for not only is the number of retorts required diminished to the extent named, but all connecting pipes, huge hydraulic mains, and the extensive system of coolers and purifyers, are dispensed with in equal proportion. The labor of handling the coal is done away with, and a large proportion of capital in the construction of works saved.

* A recent writer in the American *Gas Light Journal* states that petroleum gas gives a light 6 or 7 times as luminous as coal gas. This may be the case, but in order to avoid an error in excess, we place it at 4 times as great as ordinary coal gas: that is to say a one-foot burner with petroleum gas, is equal to a four-feet burner fed with common coal gas.

To proceed now to the question of cost. Assuming that two benches, each containing two retorts, are used for making petroleum and coal gas respectively. The cost of apparatus in the first instance is about the same. The time for heating and the fuel consumed is the same. The cost of 11 gallons of petroleum (or 1,000 feet of petroleum gas) at 6 cents a gallon (the price in Toronto) is 66 cents. The cost of 250 lbs. of coal (or 1,000 feet of coal gas, at $5 a ton, is 62½ cents. But 1,000 feet of petroleum gas is, at the lowest estimate, equal to 3,000 feet of coal gas. Hence, the cost of 3,000 feet of coal gas (equal to 1,000 feet of petroleum gas) or 750 lbs. of coal, at $5 a ton, is $1.87½. Then there is the coke to be deducted from the price of the coal used in making 3,000 feet of gas, which may fairly be set against the smaller amount of labour required in handling the petroleum, when compared with the handling of the coal.

Where petroleum is 10 cents a gallon, and coal $6 a ton, the proportionate cost of the raw materials used will be as follows:—

Cost of 1,000 feet of petroleum gas	$1 10
" 3,000 feet of coal gas	2 25

The foregoing comparisons refer to the original cost of the material from which the gases are made, but if we take the price actually charged by gas companies into consideration, the results are the more striking.

The cost of private works to supply 200 burners will be about $1,000; the labor of one man per diem; lime for purifying; three bushels of coke at 10 cents a bushel; so that the entire cost will be—

Interest on capital at 8 per cent. per ann.	$80 00
Labor at $1 per day	365 00
Lime for purifying, 200 bushels per ann. at 20 cents a bushel	40 00
Petroleum to produce gas for 200 one-foot burners, 5 hours a day throughout the year (365,000 feet of gas); 4,015 gallons, at 6 cents a gallon..........................	240 90
Fuel, say 4 bushels of coke a day, at 10 cents a bushel	146 00
Total cost...........	$871 90

The equivalent of 365,000 cubic feet of petroleum gas in coal gas is 1,095,000, reckoning one foot of petroleum gas equal to three feet only of coal gas.

Cost of 1,095,000 cubic feet of coal gas, at $2.50 per 1,000 feet (a low price in the United States and Canada)	$2,737 50
Difference per annum in favor of petroleum gas..............................	1,865 60

If the price of petroleum is 10 cents a gallon, instead of 6 cents, the difference in favor of the gas will be, per annum, $1,705.

Thus:

Interest on capital	$80 00
Labour	365 00
Lime	40 00
Petroleum	401 50
Coke	146 00
	$1032 50
1,095,000 c.ft. coal gas, at $2 50 per 1000,	$2737 50
Diff. in favor of petroleum gas, per ann.	1705 00

In works, where twelve coal gas retorts are in operation day and night, each being charged with 150 lbs. of coal they can produce 36,000 cubic feet of gas in 24 hours. This quantity can be yielded by TWO petroleum retorts in twelve hours. Thus:

2 petroleum retorts yield 1000 cubic ft. per hour.

In 12 hours the yield will be 12,000 feet.

The equivalent of 12,000 feet of petroleum gas is equal to 36,000 feet of coal gas.

If reduced to the same unit of time, namely, 24 hours, two petroleum retorts, of the same dimensions as coal gas retorts, will yield 24,000 cubic feet of petroleum gas, the equivalent of 72,000 ft. of coal gas, or as much as 24 ordinary coal retorts charged with 150 lbs. of coal each, every five hours, can produce in 24 hours.

There are other facts which make the production of gas from petroleum more economical than from coal. The quantity of lime required for purifying is not so great by one-half. The amount of water needed for cooling and washing is very considerably less, and the tar produced is small in quantity when the yield of gas is taken into account. The gas is more free from those noxious sulphurous compounds which render badly purified coal gas so disagreeable and prejudicial.

The destruction of retorts in the manufacture of coal gas is immense. This arises in a great measure from the formation of graphite in the inside of the retorts, which accumulates in concentric layers, and sometimes forms a coating one or two inches thick. The retorts also suffer to a great extent by the entrance of air when introducing the charge of coal. This source of rapid destruction is avoided altogether in the petroleum retorts, which do not communicate with the atmosphere when in a heated state, and only require to be occasionally opened to remove the deposited carbon or graphite, which, by the way, can very conveniently be removed by partially filling the petroleum chamber with fire brick, whereby the heated surface to which the rich hydrocarbon vapours are exposed is greatly increased, and their conversion into permanent illuminating gases much facilitated. The deposition of carbon is materially diminished by reducing the pressure of the gas on the retort, and this by a simple adjustment of the water joints in the petroleum apparatus may be reduced to a minimum.

The use of water in the process by which the result described in the preceding pages is produced, is for the purpose of converting the volatile hydrocarbon vapours of petroleum into permanent gases. It is thrown into its spheroidal condition the moment it strikes the interior of the retort, and in this state its spheroids continually develope steam of very high temperature and great reducing power. The rich petroleum gas may be largely diluted by the formation of the so-called water gas, but this has been shown to be an expensive process, and it is far more economical to employ a one-foot burner with a highly luminous gas than a three or four-feet burner with a diluted gas. The use of water gas as a diluant for rich hydrocarbon gases, which will burn without smoke or smell, and give a brilliant light from a small burner, is of not only very questionable economy, but it is thought by some to be a dangerous expedient, on account of the admixture of poisonous carbonic oxide into the gas, which, if leakage should by any accident occur in dwelling houses, might be followed by those fatal results to human life which have occurred time and again in every country where coal gas is manufactured, and particularly where water gas is used either with hydrocarbons or in any other form. Water gas, in order to be economical, implies the conversion of the carbonic acid produced into carbonic oxide, the one being a feeble illuminator, the other not only an incombustible, but so prejudicial to illumination that one per cent. of carbonic acid in coal gas diminishes its illuminating power by 6 per cent. The use of water gas has been interdicted by several European governments, on account of the poisonous properties of the carbonic oxide it contains. In the petroleum process, only so much water is used as will ensure the conversion of the volatile hydrocarbon vapours into permanent gases by their reduction to a lower hydrocarbon condition; and an analysis of its constituents shows that it contains much less carbonic acid than common coal gas. Its great illuminating power is derived from a very large per centage of olefiant gas, together with carbonetted hydrogen.

Mr. G. Howitz, the manager of the Copenhagen gas works, obtained 1000 feet of water gas by the combustion of 140 lbs. of coke in the furnace, and about 20 lbs. of charcoal (15 lbs. pure carbon) in the retort. The water gas consisted of the following:

Hydrogen	64
Carbonic oxide	18
Carbonic acid	18
	100

M. Gillard and M. Isard, in France, make water gas by passing superheated steam over coke or charcoal; but by their process 1000 cubic feet of mixed gases require 15 lbs. of pure carbon in the retort, and 118 lbs. of coke in the furnace.

1000 cubic feet of water gas can be obtained theoretically from 27.4 lbs. of water, although in practice much more is used, as a considerable portion of the steam is passed over undecomposed.

The following are the results of Mr. White's process, compared with that of M. Gillard:

WHITE'S PROCESS FOR THE MANUFACTURE OF 1000 FT. OF WATER GAS.

Coke in the furnace	112 lbs.
Charcoal in retort (equal to 15 lbs. carbon)	18
Lime for purifying	37

GILLARD'S WATER GAS (NARBOONE).

Coke in the furnace	118 lbs.
Charcoal in the retort	18
Lime for purifying	67

The amount of fuel expended is not only very considerable, but the lime required for the abstraction of the carbonic acid is immense. When coal gas contains 5 per cent. of sulphuretted hydrogen and carbonic acid, it requires only 15 lbs. of lime to purify 1000 feet. But by the foregoing table White requires 37 lbs., and Gillard 67 lbs. of this material to abstract the carbonic acid from the same quantity of the water gas.

The advantages possessed by petroleum gas as a cheap illuminator, have already been sufficiently established; but its claim to public patronage does not rest on this fact alone. It is a most economical and valuable source of heat. Coal-gas stoves have long been in limited use, but they have not met with general favor, because they do not supply a sufficient amount of heat, and they are besides too costly when the coal gas is maintained at $2 50 per thousand feet. Petroleum gas is admirably adapted as a source of heat. It contains a much larger proportion of carbonetted hydrogen than coal gas; but carbonetted hydrogen generates more heat during combustion than either the same measure of hydrogen or carbonic oxide, as the following table, deduced from Dulong's experiments, proves:—One cubic foot of carbonetted hydrogen, during its combustion, causes a rise of temperature from 60° to 80° in a room containing 2,500 cubic feet of air; whereas a cubic foot of carbonic oxide elevates the temperature of a room of 2,500 cubic feet from 60° to 66.6°, and one cubic foot of hydrogen raises the temperature of a room of the same cubical capacity as before stated, from 60° to 66.4°. Or in other words: a cubic foot of carbonetted hydrogen is capable of heating 5 lbs. 14 oz. water from 32° to 212°, a cubic foot of carbonic oxide 1 lb. 14 oz. through the same degrees of temperature, and a cubic foot of hydrogen 1 lb. 13 oz. of water from 32° to 212°. With a burner and apparatus of peculiar construction, and consuming six feet per hour, a petroleum gas flame from eighteen inches to two feet in length can be produced under the same pressure as is used for lighting purposes. The flame is almost destitute of luminous qualities, but the heat it emits is intense. It can be used for heating private dwellings, for cooking, and other domestic purposes. The cost of this gas fuel is, at the rate of one stove burning for 30 days, 10 hours a day, $1 30, when petroleum is 6c. a gallon; when it is 10c. the cost per month is $2. For two dollars a month, the house of a poor man may be supplied with light and fuel during ten hours of the day. With a burner of less dimensions—say 3 feet per hour—a cooking stove and a one-foot burner, supplying abundance of warmth and light for one room during 24 hours each day, may be fed at a cost of $2 a month. This, of course, is the price of the raw material alone. It is some consolation to reflect, that at a period when the price of fuel is rapidly rising in the United States and Canada, a means for affording the poor man cheap light and warmth has been developed by the discoveries of the rich stores of petroleum on the American continent.

After a perusal of this article, every candid reader will acknowledge that gas from petroleum, manufactured by the process described, is not only the most economical and agreeable mode of illumination which has yet been brought before the public, but as a cheap source of heat it may present its claim to the patronage and encouragement of the public, with the best prospects of general adoption.

THE NORTH WEST TERRITORY—THE FUR TRADE.

Whosoever chooses to wade through the voluminous documentary History of the early British colonies in America, will find that the Fur trade was the all absorbing interest for more than one hundred and fifty years in the valley of the St. Lawrence and the vast region tributary to Hudson's Bay, previous to the Second Conquest in 1759.(1)

(1) Quebec was taken by the British in 1629. Champlain and most of the Jesuits returned under free passes to France. In 1632, Charles I., by the treaty of St. Germain, resigned to Louis XIII. of France all his title to Canada and Nova Scotia, and Champlain returned to Quebec a Viceroy of Canada.

The Beaver, the present symbol of Canada, was early a source of considerable revenue to the colonies, and has far surpassed in importance all other furbearing animals, although now it is comparatively valueless, the tax on Beaver skins alone in early times being more than the present worth of the pelt, when the difference in the value of money is taken into consideration. In 1678 Sir E. Andros, Governor of New York, reports that "the rates or duties upon goods exported are 2s. for each hogshead of tobacco, and 1s. 3d. on a beaver skin, and other peltry proportionably."

Governor Dongan, under date 1687, in a Report on the Province of New York, writes, "It will be very necessary for us to encourage our young men to goe a beaver hunting as the French doe." "I send a map by Mr. Spragg, whereby your Lops. may see the several govermst., &c., how they lye, where the beaver hunting is, @ where it will bee necessary to erect our Country Forts for the securing of the beaver trade, @ keeping the indians in community with us."(1) In the same report Governor Dongan notices "the custom or duty upon every beaver skin commonly called a whole beaver, ninepence." "And that all other fur and peltry be valued acordingly, that is, for two half beavers ninepence; for four lapps ninepence; three drillings one shilling and sixpence; ten ratoons ninepence; four foxes ninepence; four and twenty mees-cats ninepence; ten mallar ninepence; twenty-four pounds of moose and deer skin ninepence. And all other peltry to be valued equivalent to the whole beaver exported out of the province (bull and cow-hides excepted)." Father de Lamberville, a cunning, zealous, but not over scrupulous missionary, wrote to M. de Denonville, Governor of Canada, in 1684, that "the envoy of the Governor of New York, who is here, promises the Iroquois goods at a considerable reduction; 7 @ 8lbs of powder for a beaver; as much lead as a man can carry for a beaver, and so with the rest." It must not be supposed that this was the actual price paid for a beaver skin at that time. Father de Lamberville merely mentions these items to show that the English were bribing the Iroquois to adopt their side in the event of war with the French, or in future extension of trade. It was a system of presents which gave origin to the Indian expression. "*Underground or secret presents*," in order to avoid the appearance of bribery. The word "underground," has recently acquired a different application, familar to every ear. The fugitives from the slaveholder reach Canada by the "underground railway." The Confederates obtain information of the movements of the Federalists by the "underground telegraph," and the late rush across the Canadian frontier from the drafting in the United States was chiefly by the "underground line."

(1) Documentary History of New York.

Father de Lamberville defeated Colonel Dongan's attempts to draw the Hurons and Ottawas to his side by "underground presents," although Dongan offered seven pounds of powder for a beaver, or as much lead as a man could carry.

The mission and the beaver were too frequently associated by the early French Missionaries. They made the fur trader and the proselytizer one. There is no doubt that wherever the fur trade extended there was but too much need of the humanizing influence of Christianity, but as long as the missionaries traded in furs, the gentle influences of religion were not felt. The condition of the colony in Denonville's time was deplorable. He himself writes, "I receive letters from the most distant quarters, from the head of River Mississippi, from the head of Lake Superior, from Lake des Lenemyngon (Lake St. Ann north of Lake Superior), where they propose wonders to me by establishing posts for the missions and for the beavers, which abound there. But in truth so long as the interior of the colony is not consolidated and secured, nothing certain can be expected from all those distant posts where hitherto people have lived in great disorder, and in a manner to convert our best Canadians into banditti."(1)

The failure on the part of the different French companies to establish successful monopolies arose in great part, from a spirit of personal aggrandizement which influenced men in power, and the excellent opportunities which the form of government then prevailing in the colony secured to them. In 1731 the administration of M. de Beauharnois was marked by continued erection of new forts and displays of military force, for the purpose of keeping the English traders within proper limits. Soon after the whole valley of the St. Lawrence came under British sway, the merchants of Montreal, among whom were many Scotchmen, seeing the advantage of united action, formed themselves into a company in 1784, and assumed the title of the North-west Company of Montreal. The stock of this company was at first divided into sixteen shares without any capital being deposited, each shareholder furnishing a proportion of such articles as were necessary to carry on the fur trade. It was soon found, however, that some of the traders in the Indian country were adverse to this union of interests, and a few of them joined together and established a rival company. As might have been

(1) Denonville's Expedition, Parie, Doc. III.

expected, a collision between the two companies soon took place, murder was committed (1) and many of the injuries which rivalry and jealousy could engender, were inflicted by both sides, far beyond the reach of retributive justice. At length, in 1787, the discontented traders and the North-west Company, came to an understanding, united their interests, and founded a commercial establishment on a sound basis, divided into twenty shares, a certain proportion being held by the merchants in Montreal, the remaining by the traders in the Indian country. The adventure for the year amounted to £40,000, but in eleven years from that date, or in 1799, it reached treble that sum, yielding large profits to the company. In 1798 the number of shares were increased to forty-six, and so rapid was the increase in power and wealth of the corporation, that the army of employees enlisted in its service rose to upwards four thousand.

The agents of the North-west Company came into frequent collision with the servants of the Hudson Bay Company, which not only led to a spirit of rivalry in trade baffling description, but also to numerous encounters in which much blood was shed and many lives lost. Wearied of this ruinous competition, and harrassed by the threatened difficulties to which the continuance of so much crime and bloodshed amongst their half wild subordinates were drawing upon them, the two companies agreed to unite, and in 1821 an end was put to contention and rivalry, by the amalgamation of the two bodies under the title cf the Hudson's Bay Company. From the date of union a new era in the fur trade began, which will be better described after a brief history has been given of one of the most successful and flourishing monopolies the world has ever seen.

The Hudson's Bay Company was incorporated in the year 1670, under a royal charter of Charles the Second, which granted them certain territories in North America, together with exclusive priviliges of trade and other rights and advantages. During the first twenty years of their existence the profits of the Company were so great (2) that, notwithstanding considerable losses sustained by the capture of their establishments by the French, amounting in value to 118,014*l.*, they were enabled to make a payment to the proprietors in 1684 of fifty per cent., and a farther payment in 1689 of twenty-five per cent.

In 1690 the stock was trebled without any call being made, besides affording a payment to the proprietors of twenty five per cent. on the increased or newly created stock; from 1692 to 1697 the Company incurred loss and damage to the amount of 97,500*l.* sterling from the French. In 1720 their circumstances were so far improved that they again trebled their capital stock, with only a call of ten per cent. from the proprietors, on which they paid dividends averaging nine per cent. for many years, showing profits on the originally subcribed capital stock actually paid up of between sixty and seventy per cent. per annum from the year 1690 to 1800, or during a period of 110 years.

Up to this time the Hudson's Bay Company enjoyed a monopoly of the fur trade, and reaped a rich harvest of wealth and influence.

In 1783 the North-West Company was formed, having its head-quarters at Montreal. The North-West Company soon rose to the position of a formidable rival to the Hudson's Bay Company, and the territory the two Companies traded in became the scene of animosities, feuds, and bloodshed, involving the destruction of property, the demoralization of the Indians, and the ruin of the fur trade. Owing to this opposition, the interest of the Hudson's Bay Company suffered to such an extent, that between 1800 and 1821, a period of twenty-two years, their dividends were, for the first eight years reduced to four per cent., during the next six years they could pay no dividend at all, and for the remaining eight years they could pay only four per cent.

In the year 1821 a union between the North-West and Hudson's Bay Companies took place, under the title of the last named. The proprietary were called upon to pay 100*l.* per cent upon their capital, which, with the stock in trade of both parties in the country, formed a capital stock of 400,000*l.*, on which four per cent. dividend was paid in the years 1821 to 1824, and from that time half yearly dividends of five per cent. to 1828, from 1828 to 1832 a dividend of five per cent., with a bonus of ten per cent was paid, and from 1832 to 1837 a dividend of five per cent., with an average bonus of six per cent. The distribution of profits to the shareholders for the years 1847 to 1856 both inclusive, was as follows;—

1847—1849, ten per cent per annum; 1850, twenty per cent. per annum, of which ten per cent. was added to stock; 1851, ten per cent.; 1852, fifteen per cent., of which five per cent. was added to stock; 1853, 18*l.* 4*s.* 6*d.*, of which 8*l.* 4*s.* 6*d.* was added to stock; 1854 to 1856, ten per cent. per annum dividend. (1) Of 268 proprietors in July

(1) Sir Alexander Mackenzie—A General History of the Fur Trade.

(2) See Letter from the Governor of the Hudson's Bay Company to the Lords of the Committee of Privy Council for Trade, February 7th, 1838.

(1) Letter from R. G. Smith, Esq., Secretary to the Hudson's Bay Company, to H. Merivale, Esq.—*Appendix to Report from the Select Committee on the Hudson's Bay Company.*

1856, 196 have purchased their stock at from 220 to 240 per cent. (1)

The affairs of the Hudson's Bay Company are managed by a Governor-in-Chief, sixteen chief-factors, twenty-nine chief-traders, five surgeons, eighty-seven clerks, sixty-seven postmasters, twelve hundred permanent servants, and five hundred voyageurs, besides temporary employés of different ranks, chiefly consisting of voyageurs and servants. The total number of persons in the employ of the Hudson's Bay Company is about 3,000.

The late Sir George Simpson was Governor of the Hudson's Bay Company for forty years. He exercised a general supervision over the Company's affairs, presided at their councils in the country, and had the principal direction of the whole interior management in North America. The Governor is assisted by a council for each of the two departments into which the territory is divided.

The seat of council for the northern department is at Norway House, on Lake Winnipeg; for the southern department at Michipicoten, Lake Superior, or Moose Factory, on James' Bay.

The council consists of the chief officers of the Company, the chief-factors being ex-officio members of council. Their deliberations are conducted in private. The sixteen chief-factors are in charge of different districts in the territory, and a certain number of them assemble every year at Norway House, for the northern department, generally about the middle of June, to meet the Governor and transact business. Seven chief-factors, with the Governor, form a quorum, but if a sufficient number of the higher rank of officers are not present, a quorum is established by the admission of chief-traders.

(1) The capital employed by the Hudson's Bay Company is as follows:—

June 1st, 1856.	£	s.	d.
Amount of assets	1,468,301	16	3
Amount of liabilities	203,233	16	11
Capital	1,265,065	19	4
Consisting of,	£	s.	d.
Stock, standing in the name of the proprietors.	500,000	0	0
Valuation of the Company's lands and buildings, exclusive of Vancouver's Island and Oregon	318,884	12	8
Amount expended up to 16th September 1856, in sending miners and labourers to Vancouver's Island, in the coal mines, and other objects of colonization, exclusive of the trading establishments of the Company, and which amount will be repayable by Government if possession of the island is resumed...	87,071	8	3
Amount invested in Fort Victoria and other establishments and posts in Vancouver's Island, estimated at	75,000	0	0
Amount paid to the Earl of Selkirk for Red River Settlement	84,111	18	5
Property and investments in the territory of Oregon, ceded to the United States by the treaty of 1846, and which are secured to the Company as possessory rights under that treaty—$1,000,000	200,000	0	0
Total	1,265,067	19	4

The Hudson's Bay Company's operations extend not only over that part of North America called Rupert's Land and the Indian territory, but also over part of Canada, Newfoundland, Oregon, Russian America, and the Sandwich Isles.

The operations of the Hudson's Bay Company extend over territories whose inhabitants owe allegiance to three different and independent governments, British, Russian, and the United States. These immense territories, exceeding 4,500,000 square miles in area, are divided, for the exclusive purposes of the fur trade, into four departments and thirty-three districts, in which are included one hundred and fifty-two posts, commanding the services of three thousand agents, traders, voyageurs, and servants, besides giving occasional or constant employment to about one hundred thousand savage Indian hunters. Armed vessels, both sailing and steam, are employed on the North-West coast to carry on the fur trade with the warlike natives of that distant region. More than twenty years ago the trade of the North-West coast gave employment to about one thousand men, occupying twenty-one permanent establishments, or engaged in navigating five armed sailing vessels, and one armed steamer, varying from one hundred to three hundred tons in burden. History does not furnish another example of an association of private individuals exerting so powerful an influence over so large an extent of the earth's surface, and administering their affairs with such consummate skill and unwavering devotion to the original objects of their incorporation.

The Hudson Bay Company, even when they relinquish the valley of the Saskatchewan and confine their operations to the region north of the 56th parallel of latitude, will still hold much of the Fur trade in their grasp. But they will do so as an independent company engaged in open competitive rivalry with all who choose to engage in that difficult and precarious traffic. The organization existing among the officers and servants of the company, their acquaintance with the habits, language, and hunting grounds of the Indians of the North American continent; and more especially the fact that they are not only personally acquainted with almost every Indian in North America, but have the means, if it suit the purposes of the trade, of communicating with them and of supplying their wants, will secure to this admirably organized association the command of the most lucrative branches of the fur trade, for many years to come! If the history of any fur-trading company in America were faithfully written, it would exhibit to the world a systematic course of action as surely destructive to the Indian race on this continent,

within the limits of the law, as if it had been a predetermined object from the beginning of their operations to the close. The history, indeed, of almost any one abandoned fort or post, during the prosperous existence of a company, would be a type of the history of the entire trade and its prejudicial influences on the Indian races. An abandoned post implies in general the utter destruction of the fur-bearing animals or of the sources of food upon which the Indian hunters formerly subsisted. It is an acknowledgment that the country which once served the post has been converted into an inhospitable desert, wholly incapable in its wild and uncultivated state of supporting the small demands of the former inhabitants of the district it served.

On another page, under the heading of Canadian Industry and Trade, will be found a table showing the annual exportation of furs and skins from Canada exclusive of the Hudson's Bay Company's exports. Although the annual amount is considerable, yet it falls into insignificance when compared with the vast exportations and profits of the present monopolists of the great North West.

GULF OF ST. LAWRENCE—ANTICOSTI.

The steps which are now being taken towards the construction of an Intercolonial Railroad in British America, give unusual value to any information respecting the little-known tract of country through which the contemplated road will pass, as well as to the great Gulf of St. Lawrence, along or near which this intercolonial trunk-line will have its course. The following article refers principally to a little-known but most valuable Island in the Gulf, which may one day become the seat of a numerous maritime population, whose industry will have a great influence upon the future prosperity of Canada and the other British North American Provinces.

Anticosti was first discovered by Cartier, in 1534, and called by him in his second voyage "Assomption;" by the pilot, Jean Alphonse, in 1542, "Ascension Isle;" and by the Indians "Natiscotec," which the French transformed into "Anticosti." *

This fine Island is 122 miles long, 30 broad, and 270 miles in circumference, and contains nearly 2,000,000 acres of land. Its nearest point is about 450 miles below Quebec. The limestone rocks on the coast are covered with a thick and often impenetrable forest of dwarf spruce, with gnarled branches, so twisted and matted together that a man may walk for a considerable distance on their summits. * In the interior some fine timber exists, consisting of birch, a little pine, and spruce. † The streams which descend to the coast abound with trout and salmon in the summer season. Seals frequent the flat limestone rocks in vast numbers. Mackerel in immense shoals congregate around all parts of the coast. Bears are very numerous, foxes and martins abundant; otters and a few mice complete the known list of quadrupeds. Neither snakes, toads nor frogs are known to exist on this desolate Isle.

Unfortunately, there are no good natural harbours on Anticosti; and in conseqnence of very extensive reefs of flat limestone rock, extending some distance from the shore, the want of anchorage, and frequency of fogs, the Island is considered dangerous by mariners; but "not in so great a degree as to render reasonable the dread with which it seems to have been occasionally regarded, and which can only have arisen from the natural tendency to magnify dangers of which we have no precise knowledge." ‡

Provision posts have been established by the Canadian Government, for the relief of crews wrecked on the Island, ‖ and three light-houses

* The Natiscotec River empties into the Gulf on the north side of the Island.

* Bayfield.

† On the authority of Pursh, the pond pine (*pinus serotina*) is found at Anticosti. This botanist visited the island in 1817. As this pine is a southern species, it having established itself on that northern island is a singular circumstance. On the same occasion Pursh brought back, in the shape of dried specimens as well as in the living state, many plants which seem peculiar to the island.—*Hon. W. Sheppard, on the Distribution of the Coniferæ in Canada.*

‡ Bayfield.

‖ To those who have drawn conclusions unfavorable to the island, from the number of wrecks which have been reported to have taken place upon it, it is necessary to point out that the wrecks, which in returns appear so formidable in the aggregate, under the head of "Anticosti," have not occurred at one spot, but at many spots widely separated, extending over a distance of 320 miles, that being the circumference of the island, and consequently the extent of coast front, not taking into account the indentations caused by bays, creeks, &c. Take the same length of coast upon any part of the main shores of the river or gulf, and it will be found, upon proper inquiry, that six times as many wrecks have occurred within it each year, as have for the same period taken place upon Anticosti. Instead of the wrecks upon the latter having been compared with the number of wrecks spread over the same extent of coast on the former, they have been generally regarded as having occurred at one spot, and have been compared with those only which have happened at some one place on the main shore of the river or gulf, of a few miles, or of less than a mile in extent, lying in the course of fewer vessels, yet wrecking annually nearly as many. From an estimate, made by the writer of this communication, of disasters in the River and Gulf of St. Lawrence, during the ten years ending November, 1849, it appears that half as many wrecks occurred upon the Manicouagan shoals, as took place upon the island in that period, and that Cape Rosier, Matane and Green Island each wrecked upwards of a third of the number of vessels which were stranded during the same period upon the whole of the 320 miles of the much libelled coasts of Anticosti. The Manicouagan shoals,

are now maintained at the west, east, and south-west points. Along the lowlands of the south coast, a continuous peat plain extends for upwards of eighty miles, with an average breadth of two miles, giving a superficies of 160 miles, with a thickness of peat, as observed on the coast of from three to ten feet. This extensive peat plain—probably the largest in Canada—is about fifteen feet above the ocean. *

Cape Rosier, Cape Chat, and other spots upon the main shores of the river and gulf, are places not only much more to be dreaded by the mariner than Anticosti, on account of the number of wrecks which occur upon them, but in consequence of the great loss of life which sometimes accompanies those wrecks, while, from the shelving nature of the beach at Anticosti, there are few instances recorded of wrecks upon the latter having been attended with loss of life. While the circumstantially related and carefully preserved account of the fate of the crew of the *Granicus*, wrecked in 1828 near Fox Bay (who, in the course of a long winter, died from famine), has created in the minds of many, who adopt without reflection any popular fallacy placed before them, a belief that every poverty of soil, every drawback of climate, and every danger of coast must belong to Anticosti, those greater dangers and those more numerous disasters upon the main shores of the St. Lawrence, attended with greater loss of life, have been almost entirely lost sight of, or if thought of in connection with the former, have been set down as unimportant, when compared with the unfairly estimated disasters and the imaginary dangers of Anticosti.

The evil reputation which still hangs over the island, became attached to it many years ago, before its coasts were thoroughly surveyed, when it was laid down in the chart as being many miles shorter than it actually is, in consequence of which many vessels ran upon it in places where deep water was supposed to exist, and before light-houses were placed there, since the erection of which, and the late survey of its coasts, wrecks upon the island have become less frequent. Most of those which now occur there are caused by the neglect of using the lead in foggy weather, many of them through the incapacity or drunkenness of masters, who generally are shamefully underpaid, and some of them through design, for the purpose of cheating the underwriters. Of these latter cases the insurance offices are perfectly aware; but, instead of endeavoring to meet them by preventive measures, they increase the rates of insurance so as to cover such losses, by estimating for them in a certain proportion to the whole; thus making the entire trade pay for the dishonest acts of the rogue. This having the effect to increase the price of freight, by which the public are the sufferers, in having to pay a proportionably increased price for all articles imported, the Government should in future institute a strict inquiry into the loss of every ship in the river or gulf, by means of a naval police, and be empowered to inflict punishment where criminal design or even gross carelessness or drunkenness may be proved to have attended such loss. Those masters who desire to lose their ships, generally select Anticosti for the purpose, because they can always manage to run them ashore there without any danger to life, and without much risk of the circumstances attending the act being witnessed or understood by persons on shore; and the provision posts being now well supplied, there is no danger, as there was formerly, of their suffering from the want of food. Thus many of the wrecks which take place there are produced in consequence of the ease with which a vessel may be beached, with safety to life, on many parts of the island, and not through its dangers of coast. In regard to the latter, those masters who know the coasts of the island well, generally make free with them (unless there happen to be a fog), in perfect confidence and safety, by which they gain headway much faster than by keeping in the centre of the channel, or along the south shore of the main land.—*Resources and Capabilities of the Island of Anticosti, by A. R. Roche, Esq.*

* Mr. Richardson; Geological Survey of Canada.

An immense quantity of squared timber and logs ready cut for the saw mill, are scattered over the south coast, having drifted down the rivers of the main land, and particularly the St. Lawrence. Some of the squared timber may have been derived from wrecks. Mr. Richardson, of the Geological Survey of Canada, who explored Anticosti in 1856, calculated that if the whole of the logs scattered along the south shore of the Island were placed end to end, they would reach one hundred and forty miles, and give about one million cubic feet of timber. Mr. Richardson concludes his report on this Island with the following paragraphs:

"The strata of Anticosti being nearly horizontal, cannot fail to give to the surface of the country a shape in some degree conforming to them. The surface will be nearly a level plain, with only such modifications as are derived from the deeper wearing in a longitudinal direction of some of the softer beds, producing escarpments of no great elevation, with gentle slopes from their summits in a direction facing the sun, that will scarcely be perceptible to the eye. The easily disintegrating character of the rocks forming the subsoil, can scarcely fail to have permitted a great admixture of their ruins with whatever drift may have been brought to constitute a soil; and it is reasonable to suppose that the mineral character of these argillaceous limestones must have given to those ruins a fertile character. It is precisely on such rocks, in such a condition, and with such an attitude, that the best soils of the western peninsula of Canada West are placed, as well as of the Genesee country in the State of New York. I have seen nothing in the actual soil as it exists to induce me to suppose that in so far as soil is considered, Anticosti will be anything inferior to those regions; and considerations of climate only can induce the opinion that it would in any way be inferior to them in agricultural capabilities.

"The three months that I was on the island were altogether too short a time to enable me to form any opinion upon the climate of Anticosti. But taking into view the known fact that large bodies of water are more difficult to cool and more difficult to heat than large surfaces of land, I should be inclined to suppose that Anticosti would not be so cold in winter nor so hot in summer as districts that are more inland and more south, and that it would not compare unfavorably with any part of the country between it and Quebec. While autumn frosts would take effect later at Anticosti, the spring would probably be a little later at Quebec.

"But such is the condition of the island at present, that not a yard of the soil has been turned up

by a permanent settler; and it is the case that about a million of acres of good land, at the very entrance from the ocean to the Province, are left to lie waste, while great expenses are incurred to carry settlers to the most distant parts of the west. Taken in connection with the fisheries, and the improvement of the navigation of the St. Lawrence, it appears to me that the establishment of an agricultural population in the island would not only be a profit to the settlers themselves, but a great advantage to the Province at large."

The scenery on Anticosti is tame, but there are parts of the coast where magnificent cliffs face the sea with towering fronts three or four hundred feet high. As no point of the interior is estimated to be more than 700 feet above the ocean, mountain scenery does not exist, but the headlands on the north coast are very picturesque; and being composed of limestone, * they often present most imposing outlines. Fox Bay, near the east point, is the scene of the dreadful sufferings and melancholy fate of the crew and passengers of the ship *Granicus*, wrecked on the coast in November 1828, before provision posts were established.

Anticosti, situated at the mouth of the River St. Lawrence, by its position commanding the Gulf, from its natural resources and the teeming life of the sea which surrounds it, capable of sustaining a large population, is of the utmost importance to Canada, and to Britain in relation to her North American dependencies. A well protected harbour and town at the west end, in Ellis Bay would be invaluable with regard to the fisheries of the Gulf. The north point is only 14½ miles from the western extremity of the Mingan Islands. A harbour of call and of refuge at Fox Bay, at the eastern extremity of the Island, would be of great advantage to the commerce of the Gulf, as well as to the fisheries. As a naval station, Ellis Bay would command both entrances to the river, and in fact control the entire Gulf. The corresponding station on the main land might be on the south, at Gaspé Bay, of which Admiral Bayfield says: "The admirable Bay of Gaspé possesses advantages which may hereafter render it one of the most important places, in a maritime point of view, in these seas. It contains an excellent outer roadstead, off Douglastown; a harbour at its head, capable of holding a numerous fleet in perfect safety; and a basin, where the largest ships might be hove down and refitted." If Gaspé Bay should be considered as too far out of the great line of communication by land between Nova Scotia, New Brunswick and Canada, the magnificent Bay de Chaleur offers every advantage which can be desired for a great inland terminus, open for the greater part of the year, and only 130 miles from Rivière du Loup, where the Grand Trunk Railway of Canada terminates. The Bay de Chaleur is 25 miles wide from Cape Despair to the celebrated Miscou Island, and 75 miles deep to the entrance of the magnificent River Ristigouche. Within this bay the climate is far superior to that of the adjacent gulf; fogs seldom enter it, and the navigation is by no means difficult.* The scenery on the Ristigouche is superb. On the north side of the valley, mountains rise to the height of 1,748 feet above the sea, at a distance of only two or three miles from the coast. On the southern or New Brunswick shore they reach nearly 1000 feet. The mouth of the Restigouche is destined to become of great importance, as it lies near to the coal fields of New Brunswick, and, when the Intercolonial Railroad is constructed, one point ought certainly to touch the head of the fine harbour of the Bay of Chaleur. If such a work could be accomplished, it would ensure steam communication between Canada and Britain for nine months in the year at least, as there are many safe harbours and roadsteads in different parts of the bay, where the largest ships of the line may lie in safety, and even ascend up to the River Restigouche, or nearly to Point Garde, with the assistance of buoys and a good pilot.†

Recent explorations establish the fact that there is a considerable quantity of good timber on Anticosti, fit for ship-building and exportation. Water power is abundant, and the timber could easily be manufactured on the spot. The manufacture of salt in the extensive lagoons on part of the south shore, might be very profitably carried on by following the methods pursued in the south of France or in the northern part of Russia, where advantage is taken of the cold of winter to concentrate brine for summer evaporation. The want of salt at Anticosti and in the Gulf generally, has frequently been the cause of the loss of an immense quantity of fish. Salines could not only be very easily constructed, but the high price and constant demand for this article would ensure the sale of as much as could be manufactured. It would be a vast annual saving to the Province if the Canadian Government were to encourage by every means in their power the manufacture of salt from sea-water on Anticosti, where all the conditions are favorable, and

* Lower and middle silurian—Caradoc formation.

The Anticosti group, consisting of beds of passage from the lower to the upper silurian, and supposed to be synchronous with the Oneida conglomerate, the Medina sandstone, and the Clinton group of the New York survey, and with the Caradoc formation of England.—*Billings; Geological Survey of Canada.*

* Bayfield. † Bayfield.

where the demand for this necessary substance in the prosecution of the fisheries is so great. A new and most important industry would soon be created, and one mean of settling Anticosti with great advantage to the commercial interests of the country secured at the outset. The Americans, the French, the Spanish, in fact every European nation has its artificial Salines ; Canada alone, with most favorable natural conditions for the manufacture of this article which costs us $700,000 annually, has not yet given attention to this most valuable source of national wealth. The present lessee of the island has a few herds of Ayrshire cattle, which remain out feeding longer than would be safe in the neighborhood of Quebec, and in the spring they look in better condition than at any place on the St. Lawrence below Quebec.*

The economic materials known to exist in abundance on the island are limited, in the present state of our knowledge, to building stones of limestone and sandstone, grindstones, clay for bricks, fresh-water shell marl, peat, drift timber, and sea-weed in great abundance. The fisheries on the coast are the same as those of the gulf generally, and already engage a large fleet of American, Nova Scotian, Jersey and Canadian vessels, and are quite sufficient to support a numerous population on the east and west extremities of the island, whose industry would furnish the fishermen with the supplies they most require, and which they are compelled to bring with them or seek in out-of-the-way ports when more are required.

The island of Anticosti originally formed a part of the country called Labrador. In 1825 it was re-annexed to Lower Canada by an act of the Imperial Parliament. The island was conceded in 1680 to the Sieur Jolliet; it is now in the hands of a considerable number of persons, some residing in England and some in Canada. It ought to be purchased by the Canadian Government, and a colonization road cut out between Ellis Bay and Fox Bay. These harbors should be improved, and the sites of two towns laid out. If encouragement were given to settlers there can be no doubt that Anticosti would rapidly become a very important adjunct to the British Provinces, rivalling Prince Edward Island in importance.† And in the present aspect of events it is desirable that it should receive attention at an early day, and the fisheries of the Gulf secured to British subjects, and both preserved and encouraged by every means that can be suggested.

* Mr. Roche.

† Prince Edward Island lies wholly within the Gulf of St. Lawrence. In 1857 it had a population of 71,496 souls, a revenue of £32,348, and exported articles to the value of £134,465, its imports during the same period amounting to £258,728. The island is 123 miles long, 32 broad at its widest part and four at the isthmus where two deep bays nearly meet.

CANADIAN INDUSTRY AND TRADE.

Statistical tables are proverbially dry and uninteresting to the majority of the reading public. Nevertheless they are frequently of great importance in shewing the direction of a people's industry, and its probable future development. It is often very troublesome to search for accurate statistical information in the parliamentary documents issued from year to year, and few have access to those which relate to the earlier years of our history. We append a few interesting tables, carefully compiled from parliamentary documents, which will be valuable to those who take an interest in our rapid commercial and industrial progress.

A correspondent has favored us with some remarks on the statistical tables published by the Legislature, which will appear in the December number of this journal.

TABLE I.

Exports of Wheat from 1838 *to* 1861.

Year.	Bushels of Wheat.	Year.	Bushels of Wheat.
1838	296,020	1850	4,547,224
1839	249,471	1851	4,275,896
1840	1,739,119	1852	5,496,718
1841	2,313,836	1853	6,597,193
1842	1,678,102	1854	3,781,534
1843	1,193,918	1855	6,413,428
1844	2,350,018	1856	9,391,531
1845	2,597,392	1857	6,482,199
1846	3,312,767	1858	5,610,559
1847	3,883,156	1859	4,032,627
1848	4,248,016	1860	8,431,253
1849	3,645,320	1861	13,369,727

TABLE II.

Value of all Agricultural Products exported from Canada from the years 1853 *to* 1861, *inclusive.*

Year.	$	Year.	$
1853	8,032,535	1858	7,904,400
1854	7,316,160	1859	7,339,798
1855	13,130,399	1860	14,259,225
1856	14,972,276	1861	18,244,631
1857	8,882,825		

TABLE III.

Comparative Statement of the Products of the Forest, during the years 1853 *to* 1861, *inclusive.*

Year.	$	Year.	$
1853	9,293,338	1858	9,284,514
1854	9,912,008	1859	9,663,962
1855	7,832,660	1860	11,012,253
1856	0,802,130	1861	9,572,645
1857	11,575,508		

TABLE IV.

Comparative Statement of Imports, exhibiting the value of Goods entered for consumption in Canada, during the years 1852 *to* 1861, *inclusive.*

Year.	Great Britain.	N. Amer. Colonies.	West Indies.	United States.	Other For. Countries.
	$	$	$	$	$
1852	9,671,132	480,954	5,115	8,477,693	651,598
1853	18,489,120	632,660	3,479	11,782,147	1,074,030
1854	22,963.331	675,115	2,673	15,533,098	1,355,110
1855	13.303,460	865,988	14,135	20,828,676	1,073,909
1856	18,212,934	1,032,595	17,613	22,704,509	1,616,736
1857	17,559,025	751,888	26,823	20,224,651	868,211
1858	12,287,053	423,826	....	15,635,565	732,083
1859	14,786,084	381,755	533	17,592,916	793,873
1860	15,859,980	393,864	15,802	17,273,029	905,260
1861	20,386,937	499,177	371	21,069,388	1,098,963

Total value of Imports of Goods entered for Consumption in Canada, during the years 1852 *to* 1861, *inclusive.*

Year.	Val. of Goods in dols.	Year.	Val. of Goods in dols.
1852	20,286,493	1857	39,430,598
1853	31,981,436	1858	29,078,527
1854	40,529,325	1859	33,555,161
1855	36,086,169	1860	34,447,935
1856	43,584,387	1861	43,054,836

TABLE V.

Table shewing both total value of Canadian Exports and Imports and the aggregate value of the Foreign Trade of the Province from 1852 *to* 1861, *inclusive.*

Year.	Exports.	Imports.	Total Value of Foreign Trade.
	$	$	$
1852	14,055,973	20,286,493	34,342,466
1853	22,012,230	31,981,436	53,993,666
1854	21,249,319	40,529,325	61,778,644
1855	28,188,461	36,086,169	64,274,630
1856	32,047,017	43,584,387	75,631,404
1857	27,006,624	39,430,598	66,437,222
1858	23,472,609	29,078,527	52,551,136
1859	24,766,981	33,555,161	58,322,142
1860	34,631,890	34,441,621	69,073,511
1861	36,614,195	43,046,823	79,661,018

TABLE VI.

Table shewing the annual exportation of Furs and Skins from Canada, exclusive of the Hudson's Bay Company's exports.

Year.	Value.	Year.	Value.
	$		$
1853	127,694	1858	163,213
1854	69,357	1859	229,147
1855	115,260	1860	227,115
1856	207,753	1861	230,596
1857	154,879		

CAUTION TO PETROLEUM REFINERS.

It is well known that one of the most objectionable impurities in coal gas is the bi-sulphide of carbon, which, upon combustion, yields sulphurous acid — a gas particularly detrimental to pictures, bindings of books, art decorations, and even to delicate constitutions. Numberless have been the expedients resorted to with a view to get rid of this noxious impurity, and latterly with some degree of success. Nevertheless the formation of sulphurous acid by the combustion of sulphur compounds in coal gas, has precluded its use in many public libraries, picture galleries, and in private dwellings.

It is much to be regretted that the rock oil furnished by some refining companies contains a notable quantity of sulphur, either in the form of sulphuretted hydro-carbons or sulphuric acid. These impurities generally arise from a neglect on the part of the refiner to remove the whole of the sulphuric acid he employs in his refining process. It is of the highest importance that the sulphuric acid should be abstracted as far as possible ; and although we do not say that during the process of refining some sulphuretted hydro-carbons may be produced which, in the present state of our knowledge it would be impossible wholly to remove, yet from actual experiment we have detected the presence of sulphuric acid in some samples of rock oil, shewing that this acid was not wholly withdrawn by the after use of alkalies, washing or other expedients. It is essentially important, in order to produce a good sample of refined rock oil, that the whole of the sulphuric acid should be abstracted ; otherwise, during combustion, sulphurous acid will be generated, and a noxious compound, very insidious and prejudicial in its effects will be generated, in greater or less quantities, by the use of rock oil. Refiners should satisfy themselves by chemical tests that every trace of sulphuric acid is removed from their samples of oil, before permitting it to go to market. Neglect in this important particular may soon engender a distaste for a beautiful and most economical mode of illumination, rendered prejudicial by inattention to simple precautions in refining, which a desire to produce a safe and saleable article ought to ensure. A piece of white blotting paper moistened with a solution of iodic acid and starch held over the flame of a rock oil lamp will become bluish purple, if sulphurous acid is generated during the process of combustion. This test, however, is not sufficient, as there may be other deoxidizing agents in the gases, resulting from combustion, which would set iodine free. The samples of rock oil may be tested with a solution of chloride of barium. If the sulphuric acid has not been wholly removed, a heavy white precipitate will indicate its presence. We would recommend refiners always to test their oil after the washing process is completed, to see if the last traces of sulphuric acid have been withdrawn. In some instances which have come under our notice, a very marked re-ac-

tion took place when tested with chloride of barium or nitrate of baryta, as well as decided indications of sulphurous acid in the products of combustion when a slip of paper, moistened with a solution of iodic acid and starch, was held over the chimney of the lamp.

THE ART OF COLOR.

The Rules of the Art of Color are easily learned, and the principles upon which they depend can be tested by a few simple experiments worked out by the cheapest materials. With a penny-worth of mixed wafers, and a few slips of colored ribbon or tinted paper, the harmonies and discords of color may be exemplified, and the eye trained to distinguish accurately between them. The slips of paper should be cut into squares or circles of about two inches in diameter, and by fastening wafers on them experiments may be multiplied without end. White and black paper should also be used, as well as white and black wafers. When white paper is employed it will be an advantage sometimes to tint the paper round the wafer with its *complementary* color. Colors, or to speak more correctly, lights are said to be complementary when two of them, taken in certain proportions, produce white. This cannot be done by means of paints used by artists, for causes which it is unnecessary to explain here ; but the fact is true, nevertheless. Now if rejecting Indigo, we take the primitive colors of the rainbow, we get a scale to which we shall have occasion to refer continually.

Primitive	*Complementary.*
Violet	Yellow.
Blue	Orange.
Green	Red.
Yellow	Violet.
Orange	Blue.
Red	Green.

Strictly speaking, there are only *three* colors (red, yellow and blue), which, being mixed, produce pure secondary colors. In experimentalizing on color, it will be advisable to sit with the back to the light, and to place the paper at least a yard from the eyes or farther, if the outline of the wafer or other object can be seen distinctly. It will be also necessary to look steadily for a few seconds, that the contrasted colors may produce their full effect upon the eye.

Confining our choice to two colors, we shall soon find that those which are prettiest apart do not always combine harmoniously, as Mauve and Magenta. Colors are something like those relations who agree best the farther they live asunder—of course, within the limits of reason. The cause of this agreement in colors we shall see presently. As soon as you bring two colors into contact they lose their strongest characteristics, and become modified. Thus, selecting three strips of ribbon of the three primitive colors, (red, yellow and blue), we shall find that, if we place them in juxtaposition with other colors, they become brighter or duller according to circumstances, each color having a tendency to monopolise its own peculiar hue by subtracting it from its neighbor.

Red—Yellow.

When these two beautiful colors are put side by side, we find that the *yellow* losses some of the red rays that enter into its composition, and appears bluish, inclining even to *green;* while the *red* is robbed of some of its yellow, and assumes a *purplish* tint.

Red—Blue.

In this case the *red* parts with some of its blue, and, becoming yellowish, inclines to *orange;* while the *blue*, parting with some of its red, appears yellower, and inclines to *green.*

Blue—Yellow.

Here the *blue* yields up some of its yellow, and appears more *violet;* while the *yellow* loses its blue, and thus taking up, as it were, more red, inclines to *orange.* If you put each of these in turn upon black or upon white, you will observe a similar modification, particularly on the edges.

It is not necessary to carry these exemplifications farther, as whatever colors we use the effects are analogous. Hence we derive a rule by which we may higher or lower the effect of every color without touching the color itself. Thus, by the juxtaposition of complementary colors—say, orange and blue—the intensity of each is increased ; but in two kindred colors, such as blue and green, are brought together, the effect of each is lowered.—*Godey.*

THE NORTH-WEST TERRITORY.

Arrangements are now being made for the establishment of an English Land Emigration Company.

The object of the Company is to purchase two or more townships from the Government on the Kaministiquia river, including the new townships of Paipoonge and Nee-bing. A portion of these townships belongs to Joseph Peau du Chat and his tribe, consisting of some two or three hundred Ojibway Indians, whose reserve on the Kaministiquia commences about two miles from Fort William on the right bank of the river, and runs westerly parallel to the shores of the lake for six miles, thence northerly four miles, and thence to the right bank of the Kaministiquia. Here is situated the Mission of the Immaculate Conception near the foot of McKay's mountain, which has an altitude of 1,000 feet above the lake. The area of the reserve is about 25 square miles, and there

would, probably, not be much difficulty in making arrangements with the Indians for the purchase of their lands. The flanks of McKay's mountain support a heavy growth of hardwood timber, as do also the flanks of many of the trap ranges between the Kaministiquia and Pigeon rivers. On White Fish river, some 18 miles from Fort William, Capt. Palliser found open larch woods, through which he and his companion, Dr. Hector, were capable of travelling on foot at the rate of 3½ miles per hour for 27 miles, between the White Fish river and the Kaministiquia. From this it may be inferred that land fit for cultivation is not confined to the valley of the Kaministiquia below the falls of Kakabeka, but that west of that river a very considerable area of good land exists, besides the trap ranges before mentioned. The English Company will not only endeavour to secure a tract of land near Fort William, but will make an effort to obtain possession of the large area of cultivable land about the Prairie Portage, in view of the completion of a line of communication between Lake Superior and Red River.

In the last and present number of this Journal, we have adverted to the immense importance of the fisheries of the Gulf of St. Lawrence and of the Island of Anticosti. In our next issue we shall describe some of the vast resources of the Great North-West, in continuation of the brief history of the Fur trade which appears in this number.

ARTIFICIAL PRODUCTION OF OYSTERS.

M. Coste, of the French Institute, states in a report to the Emperor "On the Organization of the Fisheries," that the production of oysters on the plan recommended by him, has taken such a prodigious development, that, in the Ile de Rè alone, more than 3,000 men, who have come from the interior, have already established 1,500 parks, which produce annually about 387,000,000 oysters of the value of 6,000,000 francs.

Efforts have been made by the Canadian Government, through Capt. Fortin, to establish artificial oyster beds in the Lower St. Lawrence and different parts of the Gulf. The success of the French augurs well for the effective prosecution of this important adjunct to the Fisheries of the Gulf of St. Lawrence.

Board of Arts and Manufactures

FOR UPPER CANADA.

MEETING OF SUB-COMMITTEE.

The sub-committee met at the Board Rooms on Thursday, Nov. 6th, the President, Dr. Beatty, in the chair. After reading of correspondence, and transaction of some other routine business, the following resolutions were adopted :—

Resolved.—"That the programme of examinations of Members of Mechanics' Institutes, as published in the *Journal* for January, 1861, be adopted as the programme for 1863; and that such examinations be held during the last week in May, of which full particulars will be furnished any Institute upon sending up names of candidates for examination."

Resolved.—"That the sum of *ten dollars* be awarded to each Institute establishing, and keeping in operation for not less than three months, a class or classes of not less than *ten* members, for the study of any of the subjects named in the programme, and submitting at least two members of such class or classes as candidates for examination in May next."

Resolved.—"That in addition to the certificates given to candidates at the final examinations, Silver Medals will be awarded to the most successful candidates, in the proportion of one to every five who shall pass such examinations."

Resolved.—"That the annual subscription to the Journal of this Board, for the ensuing year, be at the uniform rate of *fifty cents;* and that Secretaries of all Mechanics' Institutes, Literary and Agricultural Societies, be requested to act as agents in receiving and remitting subscriptions, to whom, for every $5 remitted, a free copy of the *Journal* will be sent."

Resolved.—"That the Secretaries of the several Mechanics' Institutes in Upper Canada be requested to furnish brief abstracts of the annual Reports and proceedings of their respective Institutions, for publication in the *Journal.*"

Resolved.—"That the thanks of the Committee be tendered W. Wagner, Esq., Canadian agent in Germany, for the donation of a stove transmitted by him from Berlin in Prussia, as a specimen for the Model Rooms of the Board."

W. Edwards, *Secretary.*

LIST OF BRITISH PUBLICATIONS FOR SEPTEMBER 1862.

Anderson (Col. W.) Mode of Manufacturing Gunpowder at the Ishapore Mills, Bengal, s. r. 8vo	0	14	0	*Weale.*
Antrobus (J.) Orator's Guide; or, the Practice and Power of Eloquence, cr. 8vo	0	3	6	*Longman.*
Baird (H. J.) Tables of Foreign Exchanges, and Weights and Measures, 4to	0	15	0	*Simpkin.*
Charley, (William.) Flax and its Products in Ireland, cr. 8vo	0	5	0	*Bell and Daldy.*
Dove (H. W.) Law of Storms Considered, 2nd edit., revised and enlarged, 8vo	0	10	6	*Longman.*

Gregory (O.) Mathematics for Practical Men, by H. Low, 4th edit., revised by J. Young, 8vo	1	1	0	*Lockwood.*
Grove (W. R.) Correlation of Physical Forces, 4th edit. 8vo	0	7	6	*Longman.*
Horton (R.) Complete Timber, &c., Measurer, for Growers, Mer., Surveyors, &c., p. 8vo	0	6	0	*Weale.*
International Exhib., 1862, Official Illust. Cat., Part 13, Classes 33-35, roy. 8vo	0	1	0	*Exhibition.*
Jackson (And.) Robert O'Hara Burke and Australian Explorer, Expedition of 1860, post 8vo	0	6	0	*Smith and Elder.*
Lukis (Capt. J. H.) Common-Sense of the Water Cure; a Description of the Treatment, &c., cr. 8vo	0	5	0	*Hardwicke.*
Marsh (Geo. H.) Origin and History of the English Language, 8vo	0	16	0	*Low.*
Miles (Wm.) Plain Treatise on Horse-Shoeing, with illust., 4th edit., sq. cr. 8vo	0	2	0	*Longman.*
Pope (Manly) History of the Kings of Ancient Britain, cr. 8vo	0	3	6	*Simpkin.*
Reason Why (The), General Science, 36th thousand, cr. 8vo	0	2	6	*Houlston.*
Trees and their Uses, fcap. 8vo	0	1	6	*Wertheim.*

AMERICAN PUBLICATIONS FOR OCTOBER.

Bates (Edw. P.) English Analysis; containing forms for the Complete Analysis of English Composition, 12mo.	$0 75	*Crosby & Nichols.*
Champlin (J. T.) First Principles of Ethics, 12mo	0 80	"
Francis (John) History of the Bank of England, including Statistics of the Bank to the close of the year 1861, or Statistics of British Finance, Currency, &c.	0 80	*Putnam & Tousey*
Hopkins (M.) Lectures on Moral Science, delivered before the Lowell Institnte	1 00	*Gould & Lincoln.*
Hooker (Prof. W. H.) First book in Chemistry, for the use of Schools and Families	0 50	*Harper Brothers.*
McGregor (P.) A system of Logic, comprising a discussion on the various means of acquiring and retaining knowledge, 12mo	1 00	"
Parrish (Ed.) Treatise on the Art of Skeletonising leaves and seed vessels, and adapting them to embellish the home of taste	0 75	*Lippincott & Co.*
Rowbotham (T. L.) The Art of Sketching from Nature, 27 vols.	0 75	*J. E. Tilton & Co.*
Sorignet (L'Abbe A.) Saered Cosmogony; or, Primitive Revelation demonstrated by the Harmony of facts of the Mosaic History, with the Principles of General Science	0 75	*P. Fox, St. Louis*

Patent Laws and Inventions.

BUREAU OF AGRICULTURE AND STATISTICS, AND PATENT OFFICE, Quebec, 29th October, 1862.

James Chase, of Brooklin, county of Ontario, Melodeon Maker, for a "Tile Ditcher."—(Dated 7th July, 1862.)

Alexr. Fraser Cockburn, of the city of Montreal, Brass-founder and Finisher, for "A compression Swivel action water cock."—(Dated 18th July, 1862.)

Marshall Kimpton, of the township of Stanstead, county of Stanstead, Gentleman, for "A new and improved water drawer."—(Dated 19th July, 1862.)

George Gauld, of the township of Onondaga, county of Brant, Cooper, for the "Archimedean Churn."—(Dated 21st July, 1862.)

Frederick Rumohr, of the village of Markham, in the township of Markham, county of York, Carpenter, for "An improved two horse Cultivator."—(Dated 21st July, 1862.)

Benjamin Thrasher Morrill, of the township of Stanstead, county of Stanstead, Farmer, for "A Metallic Milk Cooler."—(Dated 23rd July, 1862.)

Abiel O'Dell, of the town of Bowmanville, in the county of Durham, Machinist, for "A new and improved Clothes Wringer called "O'Dell's self adjusting and self fastening Clothes Wringer."—(Dated 31st July, 1862.)

Charles Hubbard Gould, of Montreal city, Miller, for "A new and useful improvement in Frictional Gearing."—(Dated 1st August, 1862.)

William Duncan Stephenson, of the city of Montreal, Gentleman, for "An improved spring bed."—(Dated 1st August, 1862.)

Archbd. McKillop, of the township of Inverness, county of Megantic, Farmer, for "A self-acting security Gate."—(Dated 5th August, 1862.)

Thomas Sholto Douglas, of the city of Montreal, Practical Chemist, for the discovery of "Benzine Copal Varnish."—(Dated 21st August, 1862.)

David Wm. Ruttan, Yeoman, and Richard York, Cordwainer, both of the village of North Port, in the county of Prince Edward, for "A spring power Boot Crimper."—(Dated 22nd August, 1862.)

Henry Fryatt, of the village of Aurora, in the county of York, Carpenter, for "An improved scrubbing Machine."—(Dated 22nd August, 1862.)

Thomas Doyle, of the village of Sweaburgh, in the township of Oxford, county of Oxford, Millwright, for "A Chair and Sofa Combined."—(Dated 22nd August, 1862.)

Abiel O'Dell, of the town of Bowmanville, in the county of Durham, Machinist, for "A Saw Set and Clamp, called "O'Dell's portable Combined Saw Set and Saw Clamp."—(Dated 22nd August, 1862.)

Joseph James Baguley, of the village of Allandale Mills, county of Peterborough, Teacher of Music, for "A Musical Modulator, styled, Baguley's Singing School Mechanical Modulator."—(Dated 25th August, 1862.)

John Soules, of Mount Pleasant, township of Brantford, county Brant, Cabinet Maker, for "A new and improved Grain and Grass Drill, designated "Soule's upright rotary Grain and Grass Drill."—(Dated 25th August, 1862.)

Francis Cant, of the town of Galt, county of Waterloo, Machinist, for "An improved Cam for working the under-needle or Catch-pin of Sewing Machines."—(Dated 25th August, 1862.)

Thomas Head, of the township of Beverley, in the county of Wentworth, Farmer, for "A Machine adapted to every kind of Churn for more efficient and speedy way of making Butter."—(Dated 25th August 1862.)

Michael North, of the town of Brantford, in the county of Brant, Builder, for "An Invention called

"Michael North's Cheap and Economical Mangle."—(Dated 25th August, 1862.)

John Marritt, of the township of King, in the county of York, Farmer, for "A Clothes Washer."—(Dated 25th August, 1862.)

William Farrell, of Carleton Place, in the county of Lanark, Carpenter, for "An apparatus for working a Common Churn."—(Dated 25th August, 1862.)

George Ross, of the city of Kingston, in the county of Frontenac, Carpenter, for "A portable frost-proof Fence."—(Dated 25th August, 1862.)

John Addison, of the city of Hamilton, in the county of Wentworth, Builder and Machinist, for "A Spring Mattress."—(Dated 25th August, 1862.)

Joseph Parizeau and Stanislas Parizeau, both of the parish of St. Martin, in the county of Laval, Carriage Makers, for "A new and Improved Churn."—(Dated 2nd September, 1862.)

H. C. Drew, of the township of Whitby, in the county of Ontario, Mechanic, for "A new and improved Water Conductor and Elevator."—(Dated 2nd September, 1862.)

Edred Drew, Cabinet Maker, and David Johns, Blacksmith, both of the township of Usborne, in the county of Huron, for "A Churning Machine to be called the Economist Churn."—(Dated 2nd September, 1862.)

Thomas Forfar, of the city of London, in the county of Middlesex, Carpenter, for "An improved Straw Cutter."—(Dated 2nd September, 1862.)

James Campbell and George Grobb, both of the town of St. Catharines, county of Lincoln, Millers, for a portable Mill Stone Cooler."—(Dated 2nd September, 1862.)

James Fletcher, of the town of Woodstock, county of Oxford, Teacher, for "An improved Circular rotatory Harrow."—(Dated 2nd September, 1862.)

Epiphane Duchesne, of the parish of L'Acadie, in the county of St. Johns, Joiner, for "A Double Action Rake."—(Dated 11th September, 1862.)

Gelston Sanford, of the city of Quebec, Machinist, for "New and useful improvements in Machinery for separating fibres from the stalks and leaves of fibre yielding plants."—(Dated 12th September, 1862.)

Eben B. Shears, of the town of Clifton, in the county of Welland, Gas Engineer, for "A process or mode by which gas made from crude earth or rock oils of Canada, known as Petroleum. may be made to burn without emitting smoke."—(Dated 15th September, 1862.)

Edward Holmes, of the city of Hamilton, Manufacturer, for "A new and improved Stave Dressing Machine."—(Dated 15th September, 1862.)

Edward Holmes, of the city of Hamilton, Manufacturer, for "new useful improvements in Machine for Jointing Staves."—(Dated 15th September, 1862.)

Edward Holmes, of the city of Hamilton, Manufacturer, for "A new and improved hoop driving and Stave Crozing Machine."—(Dated 15th September, 1862.)

Robert Anderson, of the township of Peel, county of Wellington, Plough Maker, for "A new mould board for a Plough."—(Dated 17th September, 1862.)

Peter Wesley Freeman, of the township of Loughborough, county of Frontenac, Farmer, for "A lever and Roller Gate."—(Dated 17th September, 1862.)

Richd. N. Walton, of the city of London, in the county of Middlesex, Carpenter and Builder, for "An article designated "Walton's Economical Clothes Dryer."—(Dated 17th September, 1862.)

George Campbell, of the city of Toronto, in the county of York, Blacksmith, for "A Fire Escape."—(Dated 20th September, 1862.)

Edward Lawson, of the city of Toronto, in the county of York, Merchant, for "A Double Dash rotatory Churn."—(Dated 20th September, 1862.)

Jedediah Hubbell Dorwin, of the city of Montreal, Gentleman, for "An improved Portable Mercurial Barometer."—(Dated 24th September, 1862.)

Aimee Nicolas, Napoleon Aubin, of Belœil, in the county of Vercheres, for "A new and improved Hydrometer."—(Dated 10th October, 1862.)

Notices of Books.

Ventilation and Warming of Buildings; to which is added a complete Description and Illustration of the Ventilation of Railway Carriages, for both winter and summer. By the Hon. Henry Ruttan, late Vice-President of the Board of Agriculture for Upper Canada, &c.; 1 vol., 8vo, pp. 105. Illustrated by fifty-four plates, exemplifying the Exhaustion Principle. New York: G. P. Putman. Toronto: W. C. Chewett & Co.

Having, in common with many others, been long accustomed to consider "Ventilation" as the unfruitful, though, at the same time, harmless hobby of the author of the volume before us, it was with no ordinary feelings of curiosity that we entered upon the perusal of his work. It must be confessed that the practical results of his theories, manifested in well ventilated Railway carriages and comfortably heated dwellings, have, of late years, caused some of his doctrines to receive partial recognition, and prepared many to regard with an unprejudiced eye whatever inventions and discoveries he might announce. Notwithstanding our being, to a certain extent, prepared for something more than the mere utopian projects of a visionary enthusiast, we were entirely taken by surprise in finding the book to be a plain, scientific, and thoroughly practical treatise on the theory of Ventilation, and its application to every description of human habitation.

The object of the author in publishing this work is, as he states in his preface, "to put the rising generation, and especially the young builders upon the right track, so that before long, the million—the poor as well as the rich—may avail themselves of the inestimable advantages of pure air within their dwellings, instead of the foul atmosphere in which they have been obliged to live." He then proceeds to remark that his system of ventilation is founded upon the very reverse of the generally received principles, that "that part of the air which lies nearest the ceiling, being the warmest, must necessarily be the *foulest*," and that, since warm air *naturally* rises, the proper place to let this air out is the top of the room. By his method, on the contrary, a properly ventilated apartment has, especially in winter, *the purest air at the top*, and is

so constructed that the warmed air, if not prevented *naturally falls downward.*

The book consists of two main portions; one relating to the principles of ventilation and other kindred subjects, the other to the author's mode of applying these principles to buildings of every description, railway carriages, &c. His system of "ventilation and warming," as far at least, as regards dwelling-houses, we will endeavour to state as briefly as we can.

To ventilate a building in this climate, it is necessary not only to change the air in it, but also during the greater portion of the year, to supply it with a certain degree of heat. This, of course, cannot be done by opening windows, or other apertures on opposite sides of the house, as the current of air thus produced would be intolerable, even if the process were perfect in other respects; it follows then, that a vertical movement of the air, either upward or downward, is the only alternative. Now the coolest air, as every one knows, always lies when at rest at the bottom of the room, spreading itself horizontally; the warmest occupies the top in a similar manner, the intermediate spaces being filled with strata, each occupying a position higher or lower according to its temperature. If therefore, in ventilating a room, the warm air is let out at or near the top, and its place supplied by cool air, this cool air will naturally spread itself over the floor, and then the temperature of the room will be *reduced* instead of increased by the process; and this, says our author, "has been the policy in nearly all former modes of ventilation; cold air is introduced, which, taking the heat from the occupants of the room, and from the fire, immediately escapes through an aperture provided for the purpose at or near the ceiling. Thus, proceeding on the erroneous notion that cold air only could be pure they have actually been freezing the people, when they wanted to warm them." His own principle, on the other hand, is based on the very natural supposition that we wish our houses to be comfortably heated as well as ventilated; and this he contends can only be done by taking the air out at the bottom,—thus exhausting the cooler air,—and then supplying its place with warm air brought in from the top. The fresh air being, in this case, the warmest, spreads itself in horizontal strata over the ceiling, and keeps its relative position to the whole body, until it reaches the bottom, and passes out at the aperture there provided for it. Every particle of every stratum of air is thus removed from the apartment, and perfect ventilation is secured. If, instead of this, warm air were admitted at the *bottom* of the room, egress being afforded by an aperture near the ceiling, it would go directly through the body of foul or cold air already in the room, and pass out at the top, displacing a very small portion of the original air, and neither ventilating nor warming the apartment.

For a description of the apparatus by means of which the fresh air is warmed and put in circulation, we must refer our readers to the book itself, in which the whole is clearly explained and illustrated; any account of it, to be intelligible, would require a much larger space than we can afford.

The second and larger portion of the volume is entitled, "Explanation of the Plates," and contains all the details of the author's system, illustrated with numerous elaborate diagrams, and explained in such a way as to be clearly understood by any ordinary mechanic. The latter part of it is devoted to the ventilation and warming of Railway carriages, but our limited space forbids our entering upon any description of the various ingenious appliances made use of for the purpose. Suffice it to say that they have proved completely successful in practice, as all who have travelled in "Ruttan's Ventilated Cars" can abundantly testify.

We can only add that the author has our best wishes for the success of his philanthropic efforts for the promotion of the comfort and well being of his fellow-creatures. We trust indeed, that all who read his book will rise up from its perusal as favourably impressed with the value of his system, when properly applied, as we are ourselves.

Proceedings of Societies.

TORONTO MECHANICS' INSTITUTE.

In the last number of the *Journal*, we noticed that the Directors of this Institution had determined upon establishing a number of Evening Classes for the ensuing Winter. On the 28th of October, Mr. Richard Lewis, Teacher of the English Class, delivered an introductory lecture, which was largely attended, at the conclusion of which the several classes were organized.* A great deal of enthusiasm appeared to animate the youthful members of the Institute; upwards of one hundred enrolled their names as pupils in the several classes during the first week of their organization.

We trust this notice of the successful inauguration of classes, and the publication of Mr. Lewis's very excellent introductory Lecture, may be the means of inducing many other Institutes to establish similar means of evening instruction for their members.

Mr. Lewis's Lecture.

The objects for which we are called together this evening are significant and important. They are significant as marking the character of the age and the country we live in. We meet to inaugurate the establishment of classes in connection with a Mechanics' Institute. Our aspect and our preten-

* A list of the classes and terms of admission were given in the October number.

sions are humble. We are not surrounded with the lofty and venerable associations of recognized and established seats of learning. The students whose aspirations for improvement it is the design of this institution to aid, are not entering on a professional career, with means and abundant leisure to master the most important subjects of human knowledge, with freedom from the cares and toil falling to the lot of those who have to labour for subsistence, and with all the powerful motives which the hopes of future professional success create to sustain them in their mental pursuits. The students who will form the classes to be organized here, are supposed to be the children of toil—their days are spent in arduous labour at the bench of the workshop, in the merchant's office or the store. Before they sit down to the studies of the evening classes, their energies, physical and mental, have been heavily taxed in the struggle for existence. The mere animal impulses of a man under such circumstances, would demand, not new toils and efforts, but relaxation and amusement; and the habits of society afford abundant temptations and means of gratifying such impulses. Hence it is that this meeting is significant and important. It is significant as marking the character of the age. The culture of the mind is a growing necessity, as imperative in its claims as the wants of the body. In its very lowest aspect—regarded as necessary for worldly success—it marks the advanced character of our civilization, that an educated mind has incalculable advantages over an uneducated one. But we may assuredly believe that higher and nobler motives animate many, if not all, who, under the heavy difficulties to which I have referred, seek for mental culture. The desire to master any subject of human knowledge is a noble and pure desire—the discontent with defects of education is a just and praiseworthy discontent—and he who can resist the temptations of pleasure—the instincts of animal nature to satisfy the higher yearnings of the mind manifests some of the qualities of genuine greatness. It is a step in the right direction—in that path which, receding for ever from all that degrades humanity, advances for ever to excellence and peace. It is in this that its highest significance lies; and because it is common—because it animates more or less all classes—because it is being regarded as a mark of true manliness to desire improvement—and altogether ummanly, as well as unchristian, to be satisfied with ignorance and to indulge in low and degrading pursuits—it is the most hopeful as it is the most noble feature of the age. The establishment of free institutions and just laws—the increase of prosperity founded upon industry may form high elements of civilization and means of progress; but there is no guarantee of solid and pure advancement equal to that of a people feeling their mental deficiencies—conscious of the evils of ignorance and vice, and yearning for a higher state of intelligence. This is the characteristic of the present age. With all its sins and shortcomings, all its passions and errors, it is an age of advancement and high aspirations; and no where is the advancement seen clearer than amongst the people. The institutions for popular education and the high value placed upon them, the growing demand for them—notwithstanding the resistance made to them by those who have stronger sympathies for the national purse than the national character—who measure national greatness by its dollars rather than by its virtues and its intelligence; the increasing demand for books, for Mechanics' Institutes and for schools of Art and Public Libraries, all testify to the cheering fact that it is the people who are changing in their tastes and habits, and that society is advancing to higher conditions of civilization, more lasting and beneficial because they are fixed upon purer and more spiritual foundations.

I admit that in these intellectual manifestations of the age there is much of error, bad taste, and judgment; much selfishness, disrespect of established authorities, and dreary doubts of the truth of a solemn faith and of the sanctity of venerable institutions. Science is valued for its commercial not its intellectual and moral influences. Its truths are investigated as mines of hidden wealth are laboriously explored, for the temporal riches they may yield. Books are written and read too often to gratify the passion for excitement, and sacred doctrines are examined for the sake of disproving their truth. Yet amid all these outward signs of evil, a spirit of good reigns and will finally prevail. The popular taste is no longer downwards. They who begin to delight in reading and inquiring after truth, although the reading may be nothing better than fiction, and the inquiries may lead to doubt and self conceit and error, are in a more hopeful state than they whose highest pleasures are sensual and vicious. Brutal exhibitions, once common among all classes, now only find countenance on the very outskirts of society; and if occasionally the representatives of a higher class, degrade their rank and abuse their privileges, by sanctioning vice and lawlessness—a noble fraternity of all classes, high and low, aristocratic and plebeian are working together in generous harmony and earnest zeal to advance the work of human progress. The pursuits of science, however narrow and selfish may be the motive, enlarge and exalt the mind. He who ponders the laws of Nature, who seeks to make great discoveries, who explores the elements for new and hidden powers of production, whatever be his motive, cannot fail to rise purified and elevated by his labours. Daring speculations on the destinies of our race may engage the minds of acute thinkers, and doubt may shake the empire of ancient faith, but truth is in the field, and God is above all, and the universal exercise of thought and the growing dominion of mind over brute force, is the assurance to us all that a nobler age is dawning upon our race, and that out of the present conflict and perplexity, right and truth shall be finally evolved.

Now it is these signs of the times that attach importance and interest to meetings like this. It is not in the political arena alone that the power and the hopes of nations lie. A nobler field is opening to them, free from the factious agitation, the unhealthy excitement and the false expectations of politics, and offering them richer and more lasting rewards. Political power is not the ruling power in a country. It is of little value to individual progress. Its best quality is that it leaves men alone—gives them freedom, not to exercise political privileges, but to do whatever is best for their interests. The greatest things done for the prosperity and elevation of

the people have been always done by themselves, and the best forms of government, the highest political privileges, are those which never interfere with their personal right and liberty to advance themselves. The true ruling powers of a country are its wealth and intelligence. The intelligence forms and guides public opinion, and the wealth is the source of its material power. In fact, in great commercial communities, where the prosperity and material comfort of the people depend so much upon money, no one will doubt but that politics, government, privileges of voters, are all more or less under the power of wealth. But the avenues to wealth are open to all who possess the gift of getting it. We may complain against an aristocracy of wealth governing a country and usurping the place of the ancient aristocracy of birth; but it is a just usurpation. There is nothing so democratical as trade and commerce. Its ways are countless, and are open to the whole world; and its successes are dependent upon laws, simple and clear and practicable to all. And in one respect it is an aristocracy, a best power; for wealth rightly earned is the justest, as well as the most influential power that ought to be exercised in temporal affairs. As a general rule, it is the fruit and reward of industry and skill; and because industry and skill lie more or less within the reach of all—because all can labour and all can cultivate to the necessary degree the faculties common to all men, and yet the chief ones needed for the acquisition of wealth—the power which wealth exercises is a just power. And the other power that combines with wealth is intelligence. And this again is a democratical power. For intelligence is the result of a cultivated mind, and requires only for its achievement the same industry and common ability that men need for success in acquiring wealth. Thus the two great instruments for good—wealth and intelligence—without which prosperity could not exist, progress could not be made, and neither christianity nor civilization would be advanced—are essentially popular, and no law nor predjudice, no conspiracy of privileged faction, no humbleness of birth can shut us out from reaching the one or the other. Hence no age was ever so full of hope and encouragement to the people as the present. No other age could in any such regard be called the people's age, because in the past all power lay with the few; the wealth was monopolized by the temporal ruler, and the intelligence by the spiritual; and both conspired to use them to oppress and to darken, and not to advance mankind.

It is these considerations that make a man's education of such vast importance. The educated man, with other things equal, is always the superior of the uneducated man. His resources are more ample, and he can direct his energies, his skill and his natural gifts, with more judgment and better success. A cultivated mind can influence other minds, and more easily win the confidence and respect of men. If its possessor is assailed by worldly conflicts, he can bear and resist with a calmer front and a manlier self-reliance, and rise to new efforts with surer chances of final triumph. This, however, is a general statement. Because civilization is so high, and intelligence so general, business and professional duties are compelled to advance in the same direction; and whether a man has to sell goods in a store or to make them, he whose mind is cultivated will immeasurably outstrip an uneducated competitor. For it is the proper result of study—however unnecessary it may appear to be—to sharpen the intellect, and endow it with a keener and larger power of vision. The clerk in a store, or its head, who has mastered the higher principles of arithmetic or some branch of the mathematics, may never need such knowledge in his business, but he wields a power of which he may be unconscious, to calculate, to reason, and to decide, which he never could have exercised without such training. In this light it is hard to place a limit on popular education. We are in the habit of saying that one should be educated according to his necessities. And thus we have a sliding scale to measure out certain portions of education to certain classes. To the child of poverty we award the scantiest intellectual culture, and pronounce it a piece of extravagance to enrich the minds of the poor with truths of God's universe which are only designed for, and needed by the rich. "An education suited to their condition in life," is the favourite phrase, and yet a phrase that means more than they conceive who insolently use it. For if by their moral wants and condition, education were measured out, who shall say what culture were too high and too costly for immortal creatures perishing of ignorance! If by their needs we are to judge, why educate professional men as we do in subjects which they never require in after professional life? Does the lawyer solve a point of law by an algebraic formula, or the physician probe a wound or prescribe a potion on geometrical principles? Yet who will doubt but that the admirable discipline of the mathematics, gives to both the acuteness and strength of judgment and clearness of thought, so necessary to their respective duties? And thus in every condition of life—if we decide the question by the mere outward needs of a human being—how vain and useless the toil, and time, and costliness of modern education; but, if we measure it by the claims and qualities of an immortal creature—by his capacities for good or evil—by the comparative worth of the highest cultivated minds—we have no excuse for denying to every one the highest culture that his nature is capable of, save the base and selfish one of its costliness.

> "What needs one!
> "Oh reason not the need; our basest beggars
> Are in the poorest things superfluous:
> Allow not nature more than nature needs,
> Man's life is cheap as beasts."
>
> —*King Lear.*

Moreover a new impulse has been given to invention and discovery in arts and manufactures; and the homage of civilized nations, the gratitude of the people, the honours of princes and potentates are awarded to them, who, by their skill and industry, add to human wealth and the prosperity of nations. Exhibitions of art and industry have not only awakened new interest in the production of the Mechanic's workshop: they have shown that the humblest artizan, by a scientific culture of his art, can produce works of marvellous ingenuity, and the rarest beauty combined with the highest usefulness, that exalt his labours far above the estimate which once only regarded them as the fitting pursuits of slaves. And while, by the skilful exercise of his craft, he can secure for himself public distinc-

tion and fame, he has the satisfaction of knowing that he who adds one invention to the productive powers of man is a benefactor of his race, and wins for himself a nobler renown than he who conquers empires. But here again we know that education enlarges and invigorates the faculties of man, and gives them new powers in the fields of discovery and invention. While science teaches the enlightened mechanic new principles of construction and combination; art not only gives him a deeper insight into the true principles of beauty, and exalts and refines his own taste, which itself is a reward worth years of study; but it is of direct profit to him in a pecuniary point of view, since it enables him to complete the work of his hands in the best, and most elegant, and beauteous forms—whether that work be the humble one of making a boot to protect and ornament a lady's foot—of assisting in clothing her form in the cunning fabrics of the loom, or that of erecting a temple for the advancement of learning or the worship of the Deity. It is thus, in fact, that the people truly exalt themselves, and make themselves a Power. For this power is built upon their skill and intelligence directed to create national wealth. It makes rank dependent for its enjoyments on their industry and ingenuity, which also are the true sources of national wealth and prosperity. Thus they achieve a dominion more sure and lasting than any that political privileges can give them.

Now these considerations press themselves on all who desire success. The success is sure to him who fits himself to win it, whether that success be to attain excellence in any art or trade, or that general intelligence by which one man can more or less guide and rise above others of his class. And here I desire to make the matter clear as to the meaning of this term—becoming so prevalent—success in life. I desire to make a distinction between *success* and success in life. Nothing is more common than to hear that success in life is of a man's own making, and that every one who wills, may, by the mere force of will, achieve success. The opinion, first brought out by some successful man, has been accepted; and it is taken for granted, that, whoever fails in life, that is to say, fails in becoming eminent in any profession or business, fails because he did not direct the circumstances around him as he could have done—as he should have done—and as all successful men have done. And success in life is thus pronounced to be greatness. Now, this doctrine is unjust to all who in this light fail. It falls to the lot of few to rise to the eminence of what the world pleases to call a successful man, and the success of some successful men is not always of that kind, that independence of spirit or high integrity would sanction. It is not always by industry and prudence that men rise to wealth, and it is not always that industry and prudence ensure wealth. It is not always by the mere exercise of rectitude and talent that men rise in the state, and it is not always that statesmen are distinguished for rectitude or talent. The popular idol or the successful candidate for office is not always he who has the highest claims to confidence; but sometimes he who can dispense with the qualities essential to true greatness first reaches the top of the pinnacle, which is vulgarly pronounced to be the summit of greatness. Successful men are in fact no authorities on the subject. Successful men are always apt to overvalue their own efforts, and to undervalue the circumstances that helped them to success. But failure in life in the popular sense is still so common, that we may well doubt if such success is either very desirable—very much to be respected, or at all within the great purpose of life—whether in fact it is worth the anxiety or the homage it receives. No doubt many fail because they do not act with unvarying steadiness in pursuing what they determine for themselves. They fail because their energy and resolution fail. But are these qualities—the necessary energy and resolution—the possession of all men? Are they not the result of organization, of example, of early training; and are not organization, example and training the result of so many circumstances beyond individual control, that they may be rightly classed as the mysterious dispensations of providence? It is true that human success, human happiness, good and evil, are the result of fixed and perhaps clearly understood laws. But the knowledge of these laws does not always give us the power to obey them. This is the great mystery of life; call it human frailty or what you will—that we know the right but fail in doing it. Evil still reigns, and failure in accomplishing a purpose still continues to mark the conduct of men. If some succeed—although credit may be allowed them for their energy and resolution—the causes which endowed them with the gifts of success are not of their own making. Generations may have laboured for the creation of one eminent man, as a thousand circumstances combine to help one man to success in life.

For success in life, in the low and popular sense, I see no reason to believe that mental culture is a sure guarantee. It has its successes, noble and lasting, but they are not of that kind which falls in with the popular view of greatness. Men who devote themselves earnestly to self-culture, to the study of some branch of human knowledge, to the pursuit of Truth, do not always attain eminence, fame or wealth. Their success is the inward satisfaction of having achieved a purpose—a satisfaction in the power of most—and the high sense of having done well—done to the best of their power—although that doing may never win the world's applause, or rank them among its successful men. In the view of higher natures, and of that Judge who beheld higher merit in the widow's mite than the ostentatious offerings of rich men, before whom human greatness, eminence, honour, fame, are less than dust, there may be a purer and loftier success in the life of some poor, obscure child of poverty and toil, over whose brows the laurel of genius or eminence never shone,—who may pass through life despised, and but faithfully fulfilling its humbler duties—than in their lives whom nations delight to crown with immortal renown. Then there arises the difficulty, so common, of the earnest mind struggling under the disadvantages of a defective early education, a difficulty often full of the gloomiest discouragement. When we measure those defects and see before us the vast expanse of human knowledge, the all of which we know so little, we dread to meet the difficulties. The student who in this condition begins to enter on the career of self-improvement is overwhelmed

with the sense of his own ignorance, and the first struggles are the most perilous to his future advancement. But his encouragement is to know that the first struggles are the hardest, that every successive effort and conquest not only adds to his acquisitions but also to his intellectual strength, and that as he advances the difficulties melt before resolute energy and perseverance, and the pleasure of mental triumph grows in its intensity and reality. Besides all this he is to reflect that in a practical point of view he does not want to make himself master of every thing at once, that one subject thoroughly secured may often satisfy all the necessary ends in view, whilst the discipline through which he is passing, and the new tastes he is acquiring—as well as the sense of power—prepare him for new efforts and reveal to him capacities of mind in himself of which he had no conception when he began. Those difficulties are not insurmountable, and they are the very elements of future triumphs. The harder the difficulty, the higher the moral culture, the grander the result. It is a world of difficulties we live in, but behind and above all there is ever a just, and a considerate and a tender Arbitrator. He who destined the mind for improvement gave it faculties and energies mightier than any difficulties. The strength is in us all, and if we fail it is not because we cannot, but because we will not succeed. The desire that burns, more or less, in every one's mind, to raise himself to the heights of a cultivated intelligence, is an intimation of our duty and our destiny, and he who shrinks because the task is hard—who prefers ignorance because the paths to knowledge are sometimes rocky—seeing not the glorious light beyond—fails only because he has not the manliness to advance.

Besides, there is always a tendency to over-estimate the difficulties of mental culture. Because education has been so long the privilege of the few, the multitude have grown into the belief that a good education, like refinement of manners and all the polish of high life, could only be accomplished by those who have had some peculiar faculty of birth or genius for it. A man expert in mathematics or the knowledge of language or any art—because wielding a power not exercised by the many, was supposed to be born with some extraordinary gift of genius. But the truth is, that many a mechanic has to devote more thought, to practice more patience, and to give more time and labour to attain skill in his trade, than a man gives to master a foreign language, a science, or a fine art. Why then is it that we have so many skilful artizans, and so few skilful linguists or men of science, or artists? The reason is plain. The supply depends on the demand. We need more artizans than linguists or artists, and because the business is more extensive the teachers are more numerous, and the means of acquiring the necessary skill more available and abundant. I maintain, then, that the artizan who by his industry and skill produces an article of complicated make of finished beauty, and fitted to meet all the ends in view, has manifested capacity, patience and originality of mind equal to any mental qualities exhibited by the professors of language, of science, or of art. When I behold a work of mechanical skill, so wonderfully adapted to all its uses, so admirable even in artistic beauty, whilst it is impossible for me not to do homage to the intellectual power, and patience, and thought which all the while directed the trained hand to such issues, I am compelled to reflect how much more might be done were the same intellectual powers enlarged and invigorated by an education in the principles and theories upon which all mechanical skill is founded, and how much he loses, how much we all lose, because the man is trained only as a machine, while the rich and noble stores of power in his mind, lie buried in darkness and uselessness. The great end is to make the man less a machine and more a man. It is because he is regarded only as a machine that he too often only acts as one, and believing himself incapable of higher advancement sinks into animal drudgery and animal life. His god-like faculties lie utterly neglected—or if their life cannot altogether be crushed out, because it is immortal, he rushes into the excesses of vice or lawlessness or crime.

Let no excuse then stand in the way of him who being awakened to a sense of his mental defects, desires to know more. For he has no excuse, for every difficulty he can name, history gives noble examples of self-taught men, who have encountered and overcome difficulties greater; whether that difficulty be overtaxed energies in laboring for life, infirmity of health, poverty, advanced age, the biographies of men eminent for triumph over circumstances, give us examples to shew that they contended with like foes to progress, and that they conquered not because they were more highly gifted, but because they were patient, persevering, hopeful, and made the best of the abilities they possessed—which we all can do with like if not with equal results. There is no branch of human knowledge, no science, nor art, nor language, which has not been mastered by men, working at the plough, delving in the mine, toiling at the bench, selling goods over the counter, making calculations at the desk, sailing over stormy seas, wandering over strange lands, sitting in the soldier's camp, pining in dungeons, living in storms and conflicts, hungering, thirsting, sorrowing, suffering, yet never giving in, never resting until they conquered.

Some have begun the work of self culture from mere necessity, or for worldly advancement; others have taken it up from a noble love of knowledge; others to do good by the power which education always gives; but the results have satisfied all. None who have entered into the work and pursued it with manly energy and industry have ever failed in accomplishing the end of self culture, and always with the effort has grown up a richer and nobler reward than that of knowledge itself, the habit of self-reliance, the moral discipline which educates a man to nobler issues than all schools and universities in the world could do. This is the compensation which self-educated men, or those who are compelled to struggle for education under difficulties and with wearied energies have over the more favored class of men. They gather strength as they advance. Difficulties bring out new energies and reveal to them new powers in their own souls. They learn to command their passions, to look at moral conflict with heroic coolness, to resist temptations with heroic fortitude. I do not say that the mere pursuit of knowledge does all this alone. There must be moral culture as as well as intellectual. There

must be the culture of Truth and Faith, there must be a reverence for God and his laws, an utter casting away of all base and degrading—soul-polluting influences. But thus the work of pursuit of knowledge under difficulties has the great advantage of helping all other moral and religious influences. The mere direction of the mind to intellectual pursuits is a direction *from* animal and sensual pursuits, and were nothing else to follow but the acquisition of some new mental power, there would be a gain in favour of virtue. But the conflict with difficulties is a conflict with indolence, with discontent, with the attractions of degrading pleasures, with all that helps to brutalize immortal natures, and to perpetuate the reign of sorrow and suffering amongst our race. There is a moral disease always infecting large communities which causes the multitude to look for help to every one and every thing but themselves. They can only act in masses, they can only depend on forms and systems and established authorities. It is this moral weakness that makes a people believe that every evil comes from bad government, that every reform must come from political revolutions or amended legislation. They can only save virtue by act of Parliament, and error can only be crushed by penal laws. And the moral disease infects individual character, which is its worst feature; it is leading multitudes into the dark and dreary paths of Doubt; it is uprooting all high and holy faith; it is begetting an infidelity worse than any the world has yet seen—an infidelity that beholds nothing great or heroic or holy in life, and that unable to rest in humble faith on supreme wisdom and goodness, seeks only to live in the Present with no hope for the Future. There is no peril that threatens us more than that of this moral weakness, this want of purpose in life, and its remedy lies on that mental and moral discipline so much the effect of self-culture.

No doubt there are branches of study which have a special value for their exalting and enlarging tendencies. After the claims of a trade, or an art, or a profession have been satisfied, there opens up the field of general knowledge, the pursuit of art, or of science, or of language, all of which beside the mental discipline—beside the gratification of taste or even of human pride in supplying us with a new power, still have a tendency to take us beyond the narrow boundaries of self, and to lead us towards the Great and the Infinite. And this result is inevitable, lying in the very nature of all knowledge, whatever end we have in view. When we study geology for example, it not only reveals to us a wonderful history of the past, but in carrying our imaginations over countless centuries, over the vast expanse of unmeasured time into the dim and far life of a primeval world, we are thus permitted to stand as it were in the awful presence of eternity and gaze upon the work of the Creator from the beginning and through its progress; and this association with Infinitude and Omnipotence cannot fail to re-act upon a man's moral nature and fill him with some of the qualities which he contemplates. Thus too, the mere mathematician whose highest effort may be to master an abstract problem in geometry or to solve a complicated equation, though he never step beyond the region of pure mathematics, is sustaining an intellectual influence beneficial to moral culture; but when he directs his knowledge to higher efforts, when he treads in the paths of the planets, pursues them through their mighty orbits, bids them stand still that he may measure their height and depth, and meditate on all their marvellous phenomena, his faculties grow in proportion to the greatness of his contemplations, and his studies give an elevation to his thoughts and impress a kindred grandeur on his soul.

So again, in the study of language, whether it be the mother tongue or a foreign language, when the student examines its forms of expression, and the structure and relations of sentence as symbols of thought, he is engaged in an exercise of a high intellectual character. And when he advances into the regions of its literature, when he investigates the thoughts of lofty intellects or seeks to comprehend the teachings of genius, although his purpose may only be to understand words and to use them correctly, he is acquiring a knowledge of the laws of thought and habits of logical analysis. But further than this, a just study of language cannot fail to excite a taste for the higher order of literature. We blame the people because the books in favour amongst them are low in character. We commend works of talent and genius to them. But the truth is, that they read what they understand. Popular books are suited to the popular intellect; and although it is fashionable to praise Shakspeare or Milton, or any great poet or prose writer, their popularity lies in a very narrow compass. And the reason is clear. Men of very imperfect education may understand an election speech, or a work of fiction which paints highwaymen as heroes, or fills its pages with sensual recitals of passion and insane exhibitions of love, because the language and the facts are in keeping with their tastes and intelligence; but there must be a higher education to appreciate the teachings of genius or philosophy. The mind needs discipline in the analysis, and a thorough familiarity with the force and nature of words and expressions, as well as the power to see the relations which complicated processes of reason and thought have with each other, before their true force and beauty can be discovered and their value experienced. And this is the discipline which we get even in the study of our native language, a discipline no doubt superior when it is extended to the study of other languages. And its rewards are, that it opens up rich treasures of enjoyment and sources of consolation and power in trials, in darkness, in temptations, of which they are destitute who pass through life without it. The influence of all great minds is to lift up other minds to the pure regions of thought and imagination in which they dwell, and whilst the constant study of the works of genius increases the taste for them, we gain in power, and loftiness, and expansion of thought by this association with the great minds of our race. This is the privilege of all; and it is as much the duty of all, as it is the noblest office of genius to instruct and exalt all. When the inspired poets of every age pour forth the splendid creations and hopes that flash across their minds, we may be assured that the power they wield is a divine one, and given for high and divine purposes. For genius discerns truth and mercy where common minds behold only darkness or despair. It sees everlasting beauty under the veil of dust and forms of humbleness and even of human degradation. It

utters in language and thoughts, like those of inspiration, the hopes of humanity; and while it indicates, with prophet like power, the destinies of man, it asserts the dignity and obligations of life by shewing that in the noblest affections of the soul, in the passions and virtues of humanity, nor birth, nor blood, nor race, nor clime, make any distinction.

In the commencement of this address I referred to the difficulties of those who seek self-improvement after being engaged in daily toil. Perhaps, however, the chief difficulty lies in throwing off the tyranny of old habits and in falling in with the drill, and discipline, and order of studious habits. Let the student, however, remember that the new habit grows in its power and attractiveness, that in the study of any subject of human knowledge —although there is necessarily some toil and drudgery—it differs altogether so much from the toil and drudgery of the daily life, it incessantly affords such noble excitement to the mind, its conquests which occur at every step of progress, are so pure and satisfactory, and the hopes of success and distinction so constant and bright, that it becomes less and less, as we advance, a toil. The simple fact that intellectual men grow in their attachment to study and frequently over-tax their brain, is a proof that study has fascinations and charms that take away the roughness of the labour. We suffer often more from inactivity than work; and the work that gives a new direction to our thoughts, that carries them away from the petty cares and anxieties of life, or draws them from the direction of intemperate pleasures is most invigorating and healthy. The rule of enjoyment and of advancement is simply to undertake only what we can do, and to do it thoroughly—continuously and to the end. No doubt some self-denial must be practised, no doubt the student will feel himself called upon to exercise energy, resolution, and manly endeavour. But the exercise of these qualities have not only their moral advantages; they are noble sources of enjoyment and true greatness. In referring to the efforts of men who submit to this discipline, John Foster has truly and beautifully said: "They have nobly struggled with their threatened destiny, and have overcome it. When they think with regret how confined after all is their portion of knowledge as compared with the possessions of those who have had from their infancy all facilities and the amplest time for its acquirement; let them be consoled by reflecting that the value of mental progress is not to be measured solely by the *quantity* of knowledge possessed, but partly, and still more by the corrective, invigorating effect produced on the mental powers by the resolute exertion made in attaining it. And, therefore, since, under their great disadvantages, it has required a much greater degree of this resolute exertion in them to force their way victoriously out of ignorance, than it has required in those who have had everything in their favour to make a long, full career over the field of knowledge, they may be assured they possess one greater benefit *in proportion* to the measure of their acquirements. This persistence of a determined will to do what has been so difficult to be done, has infused a peculiar energy into the exercise of their powers; a valuable compensation in part for their more limited share of the advantage, that one part of knowledge becomes more valuable in itself by the accession of many others. Let them persevere in this worthy self-discipline appropriate to the introductory period of an endless mental life. Let them go on to complete the proof how much a mind incited to a high purpose, may triumph over a depression of its external condition; but solemnly taking care that all their improvements may tend to such a result that at length the rigour of their lot and the confinement of mortality itself—bursting at once from around them—may give them to those intellectual revelations—that everlasting sunlight of the soul in which the truly wise will expand all their faculties in a happier economy."

Selected Articles.

ENGINEERING EXAMPLES—THE BRUNELS.

In the last number of the *London Quarterly*, there is an interesting essay on two of the greatest engineers of the present century, namely the two Brunels, father and son. The elder Brunel has perhaps been most widely known as the engineer of the great tunnel under the river Thames in London; the son as the author of the broad guage on railways; the engineer of several stupendous bridges, and the designer of the steamer *Great Eastern*. Sir Marc Isambard Brunel, the father, was born 1769, at Hacqueville in France, and when eight years of age he was sent to college to be educated for the priesthood. He early exhibited such a predilection for mechanics, that he neglected theological studies, and greatly pained the heart of his father, who sometimes shut him up in close confinement, and whipped and coaxed him by turns to make him cease making wooden clocks, water wheels and windmills; but all in vain. Brunel was born an inventor, and it formed part of his existence to construct machines. When he arrived at seventeen years of age, his father, who had very strong affection for him, obtained a situation for him as an officer on board a French war vessel. Being a good mathematician and draftsman, he soon became a good navigator, and he constructed his own nautical instruments. The French revolution broke out about this time, and he being a fervent royalist had to fly for his life, and so he came to New York in 1793. Here he resided for six years, and made a moderate livelihood as surveyor, architect and civil engineer. It is stated that he designed several buildings in this city, also some of the fortifications in the harbor. He went to London in 1799, and was soon engaged by the British Admiralty in constructing self-acting machinery, which he had invented for making ships' blocks. In this way he was very successful, and his reputation as a mechanical genius established. Having received a considerable sum for his invention of ship-block machinery, he then designed machinery for making shoes, and engaged in this business; but, although an able inventor, he was a very indifferent merchant, and was soon involved in debt, and put into prison, from which he was kindly relieved by the British Government paying $25,000 to satisfy the claims of his creditors. In 1822 he invented a carbonic acid gas engine, as a

substitute for the steam engine, intending to use liquid carbonic acid, which is very sensitive to the influence of heat. But, like many persons of the present day, he did not understand the subject fully, and failure was the result. About this time, it was publicly proposed to make a tunnel under the river Thames in London, but no good method for accomplishing the object was proposed. The attention of Brnnel being directed to the subject, it is stated that, while he was in the navy yard one day, he lifted a piece of timber which had been penetrated by the *teredo navalis;* and while examining the little molusc, he found that its head was armed with a pair of strong shell valves, and that it worked into the wood by having its nose attached as a centre bit to the timber, while its shell moved like an augur. In this manner it was enabled to bore under water, into the planking of the stoutest ship. Reflecting upon this natural method of boring under water by this little shell fish, Brunel was led, step by step, to invent peculiar mechanism, embracing a slowly-rotating shield, for forming tunnels under ground, and he secured a patent for his invention, submitting his plans to a number of scientific persons, as adapted for tunneling under the Thames, and the result was the formation of a company, with a capital of $1,000,000, to carry out his plan. Brunel, being appointed engineer, constructed a great tunneling machine, upon the basis of the *teredo navalis.* It weighed 200 tons. was divided into several parts, and was operated by a powerful steam engine. The work of tunneling was of a very difficult character. The river broke in several times, and operations ceased occasionally for a long period. Arragements were made to commence the undertaking in 1825 ; it was not complete and opened until March, 1843, a period of eighteen years. Some idea of Brunel's arduous labors may be learned from one fact. While the excavtions were going on by night (it went on by night as well as day), he was awakened, by his own orders, every two hours, and informed of its progress. His house was close to the tunnel, and when a bell in his bedroom was rung from below, he arose, struck a light, and examined a portion of the excavated soil which was sent up to him in a tube for inspection. A record was then made in his journal, he gave such instructions as were necessary, and went to bed again. For several months after the tunnel had been finished, such was the force of habit, that he awakened regularly every two hours during night. The Thames tunnel was successful as a feat of engineering, and the genius and endurance of Brunel shone out conspicuously in all that was achieved, but it cost $2,320,000, which was more than double the original estimates, and it was next to useless after it was finished. It proved disastrous as an investment to all who were concerned in it. Brunel died at the advanced age of 81 years, in December, 1849.

Isambard Kingdom Brunel, the son of Marc, became quite distinguished as an engineer when a youth, he acting as assistant engineer of the tunnel to his father. When it was completed, he devoted himself to railway engineering, and being somewhat ambitious perhaps for distinction, he projected the wide guage of seven feet, for the Great Western Railway in England. He produced many arguments to show that it was preferable to the common narrow guage of four feet eight and a half inches, which had been adopted by George Stephenson and others. Brunel's plan was violently attacked by leading engineers, but he was successful in carrying out his wishes. This was the parent of wide-guage railroads, and it is the most magnificent railway in the world. Some of the structures on it are splendid exhibitions of daring engineering skill. One viaduct over the river Trent is 880 feet in length ; it is supported by eight elliptical arches of seventy feet span, having a spring of eighteen feet in the centre. Gigantic square columns rise in pairs from a broad square basement, each pair being united at the top by bold architraves, forming the pier from which the arches spring. The structure imparts the idea of massiveness combined with elegance. A bridge on the same line, at Maidenhead, consists of ten brick arches, two of which are 128 feet span, each with a spring of only twenty-four and a half feet. They are the flattest arches ever made in brick. Brunel was apparently fond of executing daring projects, and doing things differently from other engineers, but he sometimes committed great mistakes. He became engineer of the Croyden and South Devon Company, for constructing an atmospheric railway, which he advocated against the opinions of several scientific engineers. He invested $100,000 in the project and lost it all, as it was a complete failure. Compressed air with stationary engines was not found equal to steam locomotives ; and in view of this fact, one of its shareholders, in 1848, described himself and his fellows, " as the most unfortunate proprietors of the most unfortunate railway in the kingdom,"

The younger Brunel was the engineer of several railways, and all the structures which he designed are distinguished for boldness and grandeur. We can form but a very inadequate idea of the great bridges and viaducts, and other similar structures on English railways, from those on most American railways. Take for example one or two similar bridges, designed by Brunel, and constructed under his superintendence. It is called Saltash Viaduct, and passes over the river Tamar, on the Cornwall Railway. It consists of nineteen arches, seventeen of which are from seventy to ninety-three feet span, and the two main central spans are no less than 445 feet each. These two central arches span the river with a double leap of 910 feet, and ships sail freely under them. This is called bow-string girder bridge. The central spans are formed of wrought iron tubes, each of which weighs over a thousand tons. This viaduct is a combination of the tubular and suspension methods ; it is cyclopean in character, is 300 feet larger that the Britannia bridge, and it is one of the greatest triumphs of engineering skill in the world. The steamer *Great Eastern* has also tended to extend the fame of the younger Brunel, and it was his last great engineering achievement. While being constructed, and especially while it was being launched under so many mishaps, his health was impaired by incessant labor and anxiety. After this vessel had been launched. and made ready for her first trip, he went on board of her, but she did not sail for a week afterwards. During this brief interval, the great engineer who had projected her, was seized with

paralysis, and just as she was gliding down the river to the sea, his spirit left this earthly tabernacle, and entered upon its voyage to "the spirit land." The younger Brunel did not possess the mechanical ingenuity of his father, but he was one of the boldest engineers that ever lived, and his ideas were of the grandest kind. "He was the Napoleon of engineers," thinking more of glory than of profit, and of victory than of dividends. He was ambitious to construct the greatest railway, and the greatest steamship in the world, and he succeeded. But although many of his projects were financially unprofitable, he was not a selfish speculator in schemes at the expense of others; he was always ready to invest his own fortune in all the projects which he proposed. The lives and labors of the two Brunels, both in those objects which were successful, and in those which were failures, afford lessons in engineering to future generations.—*Scientific American.*

A COURSE OF SIX LECTURES,

On some of the Chemical Arts, with Reference to their progress between the Two Great Exhibitions of 1851 *and* 1862, *by Dr.* Lyon Playfair, *C. B., F.R.S., Professor of Chemistry in the University of Edinburgh.*

Calico Printing—Showing the Important Chemical Manufactures dependent on this Art, and some of its Preliminary Processes.

Lecture III.

In my last lecture I brought before you various colours produced by coal-tar which had recently been employed in the art of calico printing. I also at the same time mentioned to you that the discovery of these colors from coal-tar was likely very materially to alter the whole art of calico printing, which, in its present aspect, involves some beautiful applications of science. You will readily understand that, after we have gone over the preliminary processes connected with this art.

"Calico printing" is a generic term. Although the term "calico" is used in it, it embraces all the arts of making dresses with colored patterns, whether they are manufactured from silk, from woollen, from linen, from cotton, or from any mixture of those materials. It is, therefore, merely a generic term, describing the ordinary dresses which receive designs by means of impression and not by mere dyeing. The name "calico printing" was originally derived from Calicut, in Hindoostan, where the art of impressing cotton with colors was carried out to a great extent, although the same art had been employed long before in Egypt as regards linen. The skill of the printer consists in placing as many colors as possible upon the tissue, and deriving them from one dyeing material; for all his supplementary processes are merely confessions of his inability to produce all the colours which he desires from one material. Pliny gives us a description of the manner in which the ancient Egyptians practised the art, and his account is so excellent that I could not possibly give you a better explanation of the art of the present time. I therefore quote it in full. "Robes and white veils," says Pliny, "are painted in Egypt in a wonderful way. They are first imbued, not with dyes, but with dye-absorbing drugs, by which they seem to be unaltered, yet when they are immersed for a little while in a boiling caldron they are found to become painted. Yet, as there is only one color in the caldron, it is marvellous to see many colors imparted to the robes in consequence of the influence of the excipient drug. Nor can the dye be washed out. A caldron which would merely confuse the color of cloths previously dyed is thus made to impart several pigments from a single dye stuff, painting as it boils." You will find as I proceed in the description of the art that this latter term of Pliny's, "painting as it boils," is a true description of the art as now practised. Since the time of the ancient Egyptians the practice of calico printing has made enormous strides, and yet it would be impossible in the present day for any one to write a more concise or accurate description of the art even as now practised, than Pliny has done of the condition of the art of the old Egyptians. Although the principles upon which the art was carried out were known in former times, yet its resources have vastly improved. I may mention as an instance that it is recorded that Alexander the Great wore a pectoral of printed linen — probably not better, and certainly not nearly so gaudy, as those Turkey red handkerchiefs which we are accustomed to send to Brazil and Mexico to adorn the lowest classes of the population.

The British calico printing trade is now of great magnitude. It consumes one-seventh of all the cotton which is imported into this country. Perhaps this may not give you an idea of its largeness, and therefore I will put it in another way. There are printed annually, in this country, thirty-one millions of pieces of calico, which is equal to 450,000 miles. This is also a method of indicating the largeness of the subject which it is difficult to understand: supposing you were to measure the calico annually printed in Great Britain by a gigantic standard measure — take the diameter of the earth as your "yard measure," with which you are to measure the calicos printed in Great Britain in one year—you would require to stretch it along the diameter of the earth fifty-six times; or, if you were to wrap the whole world round with a bandage of the calico printed annually in this country, you would envelope it in nineteen folds. You will hence see that it is an art of great magnitude, and it is one which, therefore, justly draws our attention, not only on account of its importance as regards itself, but also (and this, as you will observe by the programme, is mainly the subject of my lecture to-day) on account of the arts which it brings into its train, and the important manufactures which it creates and helps to sustain. To-day's lecture is therefore directed to these arts, and to the preliminary processes in the printing of calico.

The preliminary processes are numerous. I will merely enumerate them in their names just now. There are six of them.

There is, first, the bleaching of the calico; second, the application of the mordants, or what Pliny has called the "excipient drugs," which drag the color out of the bath and fix it upon particular parts of the fabric; third the resists or discharges, which keep the calico white at particular

parts, or produce a white pattern; fourth, the ageing which will explain itself when we come to it; fifth, the dunging or the fixing of the mordants; and, sixth, the dyeing.

I commence with the bleaching. The bleaching of the calico is an exceedingly important part of the process. On the right hand side of that small table you will see the calico as it is delivered to the printer from the weaver. It is of a grey color, and not at all adapted for the purpose of the printer. It contains the flour and the grease which the weaver uses in his operation. It also contains a natural resin, which prevents the calico from taking on the color, and it is necessary that all this should be removed, and that the calico should be converted from that dirty grey into a white before the calico printer can use it. Well, up to the last two years of the last century—to 1798—the bleaching of calico was an extremely formida-able operation. It required for its completion from the month of March to the month of September. After the grey calico was boiled in alkaline lyes to take out the grease of the weaver and the rosin of the natural calico, it was spread out in vast fields, and was exposed to the action of the sun and moisture, being occasionally watered, first with water, and then with buttermilk; and in this way a true combustion took place. Under the influence of the sun and the moisture the oxygen united with the coloring matter and burnt it; and the coloring matter was thus burnt out of the cloth, and the cloth became white. In this combustion, however, part of the cloth itself was burnt, and the texture was often injured; but the greatest evil was this — that every calico-printing works, in order to bleach its calico for use, required vast estates in connection with the works, upon which to spread out the calico to the action of the sun and air; or in absence of these, the printers sent the calico to Holland to be bleached. The bleaching, therefore, became an extremely expensive part of the operation. Towards the end of last century it was discovered that bleaching might take place in a much more easy way; but the circumstances that led to this discovery are so interesting, that I would not hesitate, if we had not so much before us, to give you a description of the manner in which this discovery resulted. I will do so in a few words. France, during the revolution, was shut out from a supply of soda, which was used to dissolve out the resin of the calico, from Spain, where it was manufactured under the name of barilla, being derived from the ashes of sea-weed. Our cruisers were vigilant, and we shut out this supply of soda from France. The consequence was that the soap-boilers of Marseilles were nearly ruined, and the manufacturers of calico also suffered extremely. Accordingly, the government offered a high reward to any person who would discover how to make soda from sea-salt. Sea-salt, as you are aware, contains the metal sodium, but united with chlorine and not carbonic acid. It was sagaciously thought that soda might be made out of it; and it was ascertained that, some time before, Leblanc, a private manufacturer, had actually practised a method for converting this common salt into soda. The process is a complex one. I cannot describe it to you further than by stating that the first step is to treat the common salt with sulphuric acid, which drives off the hydrochloric or muriatic acid, and leaves sulphate of soda behind. This is then treated with carbonate of lime, and is converted into carbonate of soda. For a long time the muriatic acid from the common salt went out through tall chimneys into the atmosphere, and devastated the country by destroying vegetation. It is this of which Lord Derby complained in the House of Lords the other night, and which led him to move for a committee to inquire in what manner manufacturers can be restrained from sending these injurious gases into the atmosphere. Lancashire alone converts 135,000 tons of common salt into carbonate of soda every year. This hydrochloric acid was for a long time lost, but it was soon found to consist of chlorine and hydrogen; and this chlorine possesses strongly bleaching powers. I have here some of this chlorine dissolved in water. If I add to it a coloring matter such as this indigo you will see that the color quickly disappears. The color of the indigo is removed from it.

When it was found out that chlorine had such a power for destroying color, persons began to think that it might be employed as a bleaching agent, instead of exposing the calico for such a number of months to the action of the sun and air. Now, the mode by which this bleaches the color is by the decomposition of water. Water, as you are aware, consists of hydrogen and oxygen, and the chlorine has a great love for the hydrogen and desires to unite with it; and so it takes away the hydrogen from the water, and forms hydrochloric acid with it; and the oxygen liberated from the water goes and burns away the coloring matter. You know that ordinary combustion in a fire-place is the oxygen uniting with the material of the fire. So here, the oxygen of the water, being set at liberty by the hydrogen uniting with the chlorine burns the coloring matter and destroys it, just as the oxygen burnt the coloring matter when the calicoes were exposed to the air in the old process of bleaching.

After a time it was found that if this chlorine, which is a gas, was passed over lime it was absorbed by the lime, and formed what we are now so familiar with as bleaching powder, and that this bleaching powder bleached just as well as chlorine did, and without having the irritating smell and the irritating action on the lungs which are common to chlorine. As soon as the property of bleaching-powder was discovered, an extraordinary impulse was given to the process of bleaching. After the resinous and fatty matters have been removed from the grey cloth, it is treated with a weak and clear solution of chloride of lime. In this action the chlorine, desiring to unite with the calcium of the lime, accomplishes this by liberating the oxygen which destroys the coloring matter. From beginning to end of the operation of bleaching only five days are necessary instead of the months which were formerly required. Five days are occupied in converting this grey cloth into white cloth, to make it ready for the calico printer who is generally his own bleacher. The cloth is first singed by being passed over a red hot cylinder, as you see represented here in the second diagram. This is done tolerably slowly, in order to take away the fibres and clean them from the surface. The texture, however, does not get injured.

After being passed over the red hot cylinder it appears in this state—a little browner. It is now boiled in lime. The lime loosens the resins, and forms a compound of resin and lime on the cloth. This is boiled with dilute sulphuric acid in order to dissolve out the lime and liberate the resin. It is now boiled in a solution of carbonate of soda—the substance is made from common salt, and it renders the grey calico much whiter than it was before. After that it is passed through a solution of chloride of lime. There are one or two boilings which I need not enter into, but the mode in which the boiling is effected is interesting. There is a diagram representing the "bowk," as it is called, or the vessel in which the boiling of the soda and the lime takes place. You see the calico is coming in by machinery, and a boy is represented spreading it along the floor of the caldron. In this there is placed, after the boy of course has departed, a quantity of water and a quantity of carbonate of soda; and there is an elegant fountain arrangement which cannot be represented there on account of the boy being present, by which the hot fluid is thrown up to the top through these tubes. It is prevented by the arch at the top from getting out, and is thrown in a fountain-shape over the cloth below, so that it it is continually percolating through it, and coming down over it; and in that way the resinous matter is completely removed from the cloth. The latter is now passed through a solution of bleaching powder—chloride of lime, consisting of lime and chlorine. The chlorine has a great desire to unite with the calcium, the metal of the lime, and form chloride of calcium, and the oxygen being set at liberty burns away the coloring matter of the calico and bleaches it. There would appear to be no decomposition of the water, as in the case of bleaching with chlorine in the form of a gas. All these operations—boiling in lime, boiling in soda, steeping in the bleaching liquor, and all the operations of washing and drying, occupy only five days from the beginning, and it is carried on in works of small extent. No estates are necessary in connection with the works. The verdure of miles of country is no longer defaced with outstretched calico bleaching in the sun.

Before parting from this subject, let us pause here to consider how this method of bleaching has raised up several important manufactures.

The soda-ash trade is of enormous extent, and is now carried on by extensive manufacturers to supply materials for bleaching and washing soda. Sulphuric acid is necessary in its production, as I told you; so that the price of sulphur regulates the price of calico. The price of sulphur also regulates the price of other materials, such as soda, and of glass, in making which soda is much used. About twenty years ago, as many of us recollect, the King of Naples was persuaded by a Marseilles firm that it would augment the small revenues of his country very much if he gave that firm a monopoly in all the Sicilian sulphur. They immediately raised the price of sulphur from £5 to £14 per ton. Our calico trade, soap trade, glass-works, and various other interests were soon affected by this proceeding, and the consequence was that our Government were obliged to take some of the Sicilian sulphur and convert it into gunpowder, with which our fleet went to Naples, threatening to bombard that place unless the monopoly was abolished. The Neapolitan Government did not like the return of their sulphur in this form, and so they permitted the export on the old terms, and our manufactures again flourished. But what was the consequence of this short monopoly. Naples has lost enormously by it. Like all foolish experiments of this kind on trade, it had a most disastrons effect upon those who made it, and it has had a most beneficial effect upon our sister country Ireland. The skill of our chemists was brought into play to see whether they could not discover sources of sulphur in our own country. We found an abundant supply of sulphur in iron pyrites, which exists in such large quantities in Wales and Ireland, and also in Spain and Portugal. The consumption of Sicilian sulphur is thus much reduced.

There are one or two other things in connection with these arts which I must allude to very shortly as my time is going on.

In the manufacture of this bleaching powder, where chlorine is made, hydrochloric or muriatic acid is boiled with peroxide of manganese, and this produces chlorine. All the manganese was, until recently, wasted after the operation. The chloride of manganese was a waste product, and there were no means discovered for getting back this expensive salt—for producing again the peroxide of manaanese after it had been boiled with hydrochloric acid. A beautiful plan has been recently invented, but which will be appreciated chiefly by the chemists present. The protoxide of manganese produced by precipitation from the chloride will not absorb oxygen from the air to form peroxide of manganese, but carbonate of manganese, MnNOC-O_2, when roasted in air, allows its carbonic acid allows its carbonic acid to be displaced by the oxygen of the air, and peroxide of manganese, MnO_2, is thus produced. I here take a little of this carbonate of manganese, which is a white or nearly white substance; if I gently roast it, stirring it at the same time, you see that it becomes the ordinary brown oxide of manganese, the carbonic acid having been displaced by the oxygen. In this way all this manganese, or, at least, the greater part of it, is recovered.

There is another interesting process for producing bleaching powder, which has been made within the last few years, and which my chemical friends here will fully appreciate if they are not acquainted with it already, but which I fear I shall scarcely make intelligible to a general audience. It was devised by Mr. Shanks, of St. Helen's. First common chrome ore is roasted with lime, and is thus converted in the usual way into chromate of lime—this yellow salt which I have here. The chromic acid in this compound contains oxygen. The chromate of lime is boiled with hydrochloric acid, the hydrogen of which is taken away by the oxygen of the chromic acid. Chloride of chromium is formed, and part of the chlorine is liberated which combines with the lime to form bleaching powder. The chloride of chromium remains in solution. This chloride of chromium is again treated with lime, and precipitates oxide of chromium with which we started, and chloride of calcium remains in solution. Now, this oxide of chromium is merely mixed with more lime and

roasted again in the air. It abstracts oxygen from the air, and forms again chromate of lime, another of the substances with which we started; so that by this beautiful process the oxygen is continually taken from the air, forced to unite with the hydrogen of the hydrochloric acid, and the chlorine, entering the lime, forms bleaching powder. The process is, therefore, elegant, but is not yet extensively employed.

(To be continued.)

THE INDESTRUCTIBILITY OF FORCE.

(From Macmillan's Magazine.)

That all living things are doomed by death is a truth so urgently forced upon man that the very savage can hardly escape from moralizing about it; but he falls back upon the belief that, though her children perish, Nature herself is unchangeable; though storms and wintry change may ruffle her countenance, the features are as imperishable as the solid framework of the globe itself. The nineteenth-century man is deprived of this soothing notion. Irrefragable evidence has been laid before him by the geologist that nothing is as it was, nothing as it will be. "Alps and Andes are children of yesterday;" rivers do not flow on for ever: between the granite rock and the cloud it is but a question of time; with the stability of both the forces of nature are ever at war. Yet the fact that underlies this universal destruction is, Indestructibility. The atoms with which these everchanging forms are built up are absolutely changeless. *They*, at least, bid utter defiance to time. They never wear, never grow old, never lose one iota of their original endowments. "A particle of oxygen," says Faraday, "is ever a particle of oxygen. If it enter into composition and disappear as oxygen—if it pass through a thousand combinations, animal, vegetable, mineral—if it lie hid for a thousand years and then be evolved, it is oxygen still, with all its first qualities, neither more nor less.

What are its first qualities—the qualities of matter generally? If we consider attentively, we find that they all resolve themselves into certain powers—forces. "We know matter only by its forces," says Faraday: *weight*, for instance, or gravitating force, the universal attraction of every atom by all other atoms; *cohesion*, or the attraction of certain like particles for each other; *chemical affinity*, or the far more energetic attraction of certain *un*like atoms for each other; *heat-force*, the antagonist of cohesion, which, according as it prevails or is prevailed over, determines the form of matter, whether solid, fluid, or gaseous; *visibility*, or the power which the atoms of matter possess over *light*. Reflection, refraction, interference, absorption, polarization—all these are only names for the different kinds of power which matter exercises upon light—power, so to speak, which compels it to become the messenger of the secrets of the constitution of bodies to the human eye and brain. The undulations of light which "break upon the retina as waves upon the sea shore," betray by their condition the varying influences to which they have been subjected by the way. Last, not least, *electricity*, subtlest, most Protean of all the forces of nature. With opposing, or dual attributes, it invests every atom of earth, air, and ocean, and of all they contain, but gives no outward sign of its existence, except when the equilibrium of these opposing tendencies is disturbed.

These, then, are the inseperable qualities of matter; we cannot conceive of its existence apart from them; and if matter cannot (humanly speaking) be annihilated, so neither can these forces be. Such is the meaning of that which has been called the "grandest generalization of modern science," the principle of the CONSERVATION OF FORCE. One half of this great principle, namely, that relating to matter, was early recognised, though, "perhaps, its distinct reception in philosophy may be set down to the overthrow of the doctrine of Phlogiston and the reformation of chemistry, at the time of Lavoisier." But the other half, the Indestructibility of Force, was not securely grasped till within the last twenty years. There was indeed, an implied acknowledgment of the principle in the third law of motion, that action and reaction are equal and contrary. But as to applying the same to all the forces of nature—heat, light, chemical affinity, electricity, magnetism, as well as gravitation—or even clearly recognising these *as* forces, it was not possible, until the recent rapid development of the physical sciences, especially of chemistry and electricity, had brought to light the fact that these forces can change into one another—electricity into chemical action, into heat, into light; heat into motion, motion into heat, &c.; that, when a certain amount of force of any kind disappears, or seems utterly spent and annihilated, it is manifesting itself as *some other force*. Not until this mutual convertibility of forces was distinctly apprehended, could the doctrine of the "conservation," or indestructibility of force, be more than a mere assertion, a guest, with appearances mostly against it.

To settle the claims of priority in scientific discovery is not only a difficult, but happily an unimportant task; for, as it has been well said by Professor Tyndall, "great scientific principles, though usually announced by individuals, are often merely the distinct expression of thoughts and convictions which had long been entertained by all advanced investigators." In literature it would be little short of a miracle for two original men to hit the same mark, seeing that each has a widely separate aim and stand-point. In science, on the contrary, many are pressing towards one goal. In the present instance, however, it seems universally agreed that to M. Meyer, of Heilbronn, is due the honour of having been the first to give "distinct expression" to the principle of Conservation of Force; to a perception of which his physiological researches conducted him. But what we may call the first general survey of the field, the first attempt to trace out the connexions of all the forces of nature with each other (the true key to their modes of "conservation"), was made by Mr. Grove in his lectures on the Correlation of Physical Forces delivered at the London Institution in 1843. Guided partly by him, partly by subsequent writers, we propose to grope our way through a somewhat tangled path. It is not through indolence that we quote freely from others, but in the desire, wherever possible, to set this great and sometimes startling subject before the reader in words of authority.

When a spent ball drops to the ground, so strongly

does it impress us with the notion that this word "spent" conveys the literal truth, and that the force which was expended to set it in motion is exhausted, that we can hardly shake off the idea in spite of better knowledge. Yet the very first law of motion teaches us that force cannot thus exhaust itself, and that a body once set in motion would go on for ever if there were nothing to stop or hinder it. But the air resists, the earth attracts, and both together soon overpower the force originally impressed on the ball. Overpower, yes; but do they destroy it? Certainly not. Part is taken up by the air, part by the ground on which it falls, and part we should find, had we sufficiently delicate means to test it, under a wholly new manifestation in the ball itself; namely, as *heat.* When the motion of the mass ceases, a motion of its constituent molecules begins, a movement of mutual repulsion or expansion which we call heat. In such a case as this, however, the original amount of force employed is so small that, in its altered and subdivided state, we cannot follow it, nor experimentally prove its entire "conservation," any more than we can test the indestructibility of matter by collecting and re-weighing the particles of a burnt-out candle. Yet no one doubts that in an altered condition they continue to exist. But, if we intensify the force and limit its direction, as in percussion or friction, then we obtain an accumulation which cannot elude us. And how does it manifest itself? Unmistakably as *heat.* A piece of iron may be made red-hot by mere hammering. And it is not enough to say vaguely, that striking or rubbing produces heat. We must regard it "as a continuation of the force, whether of the human arm or from whatever source, which was previously associated with the moving body, and which, when this impinges on another body, ceasing to exist as gross palpable motion, continues to exist as heat." On this view we may readily understand why hard bodies, such as flint, steel, glass, metals, give the greatest amount of heat from friction or percussion. The greater the resistance to motion, the greater the development of heat; the less the resistance, as in fluids, the less the resulting heat, for their particles, being very mobile, take up instead of opposing the motion impressed on the mass. Friction is simply impeded motion; and to lessen friction, as by smoothing or oiling a surface, lessens the development of heat, because it lessens the amount of force required to overcome the resistance. Thus, too, the heat resulting from friction in the axle of a wheel is diminished by surrounding it by rollers; these take up the primary motion of the axle, and, the more unimpeded the motion, the less heat."

We shall be more ready to receive this idea of the actual transformation of motion into heat, if we pass in review a few of those facts which most plainly indicate the true nature of heat as a dynamic force, and then glance at the other half of the truth, how heat may be changed back into palpable motion, or the motion of masses. How do we test heat? Always by motion—molecular motion or expansion, that is. The mercury *rises* in the thermometer; in other words, it expands in the only direction in which there is room for it to do so. Heat weakens the cohesion of solids, till at length they cease to be solid and become liquid. Liquids under heat's influence expand into gases. Gases increase in volume so rapidly and violently that they break all bounds. But the reader will say, this may be true of most substances; yet some absolutely contract on the application of great heat. Your cook tells you that meat and vegetables diminish in bulk or "waste" in the process of cooking. But, if we examine carefully what happens, we find that, so far from being an exception, these are an extreme case of the rule. For, meat and vegetables being of a mixed nature, part solid, part fluid, the fluids expand into and escape as vapour, leaving the solid particles between which they were contained in a collapsed state. There are other apparent exceptions far more difficult to explain. Water, for instance, and some other substances expand as they approach the freezing or solidifying point. It is possible, says Mr. Grove, that, as this only occurs with bodies that assume a crystalline form, they may in solidifying undergo some structural alteration, some peculiar arrangement of their particles which causes them to occupy more room. At all events, the fact is equally difficult to explain in accordance with every other theory of heat that has been advanced.

The sensation of heat in our own bodies is not irreconcilable with this view of heat as an expanding or "molecular-repulsive" force, though at first sight it might appear so. "The liquids of the body are expanded, that is, rendered less viscid by heat, and from their more ready flow we obtain the sensation of agreeable warmth. By a greater degree of heat their expansion becomes too great, and causes pain; and, if pushed to extremity, as with a burn, the liquids of the body are dissipated in vapour, and an injury or destruction of the organic structure takes place." There is a far more refractory-looking case in "latent heat." How can we imagine an expansive force "latent?" It must either cause expansion or cease to be heat. We accept the alternative. But, first, let us come to a clear understanding of what is meant by that perplexing expression, latent heat. It is heat which does not manifest itself *as* heat, or temperature, nor in fact give any sign of its existence, until some change in the physical state of the matter in which it exists—a change either from solid to fluid, or fluid to solid, or fluid to gaseous—calls into activity this latent heat and enables us to detect its presence. For instance, to take a case of heat that was manifest becoming latent: "a given weight of water at a temperature of 172°, mixed with an equal weight at 32°, will acquire a mean temperature of 102°. But water at 172°, mixed with *ice* at 32°, will be reduced to 32°." What, then, has become of the heat over and above the 32° that was in the water? We are told it is "latent." But that is only hiding its disappearance under a fine name, whatever theory of heat be adopted. Looking to facts, we see that there is as much *work done* by the heat in this second case as there was in the first. For, the ice being a solid, a greater amount of cohesive force has to be overcome in making it liquid than in merely raising the temperature of what was already in that state. The water, therefore, yields up to the ice heat (*i. e.* force) enough to tear asunder the particles of the ice, and maintain it in a fluid condition. Hence its own contraction or fall to 32°. And this heat

partially changes its nature while thus engaged in "interior work," as Dr. Tyndall calls it. For it is no longer able to communicate itself to the thermometer, or whatever test you may apply. Now this power of communicating itself is one of the most striking characteristics of heat. We raise the temperature of a body merely by " bringing it near some other heated or expanded substance." We must, then, look upon " latent heat" as, to some extent, a transmutation of force.

The change of heat into motiom is so much more obvious and familiar a thing (as in the steam-engine, for instance) than that of motion into heat, that we are prepared to receive it with less surprise or incredulity. But we must keep steadily in mind the " peculiarity of the modern view of the subject, that heat cannot do mechanical work and continue heat." It does more than produce; it *becomes* palpable motion, passing from the movement of particles to the movement of masses. Therefore the disappearance of heat is in exact proportion to the work done. And as this side of the subject touches on the utilitarian, it has been investigated with special industry. Mr. Joule of Manchester has ascertained the precise amount of work a given quantity of heat can do—" the mechanical equivalent of heat." He finds that " one unit of heat, or that quantity which is necessary for raising the temperature of a pound of water one degree centigrade, is equivalent to the mechanical work by which the same mass of water is raised 1,389 feet." (Helmholz.)

We have seen how mechanical force can pass into heat. It can, in like manner, produce electricity and magnetism. In friction, for instance, if the two substances rubbed together are strictly homogeneous, heat alone is the result; but, if they be heterogeneous, electricity accompanies it. Hammering, twisting, bending—the force employed in all these operations reappears in part as magnetism, in iron and steel, to so decided an extent as to add one more to the many complications which, in an iron-built ship, disturb the action of the compass. The direction of the magnetic force thus produced is dependent on the position of the ship's head and keel while building—a fact well established by that able and energetic investigator of magnetic phenomena, the late Dr. Scoresby.

If we take *Electricity* as our starting point, the transformations of force are even more varied and startling. As heat the most intense, light the most brilliant, chemical action the most searching and powerful, can this subtle and all-pervading force manifest itself. By attraction and repulsion it can do drudgery as a mechanical motive power; and in the electro-magnet we see it far surpassing in energy every other source of magnetism.

Chemical Affinity can be converted into heat and light, as in combustion; into motion, as with the explosive effects of gunpowder; and into electricity in the voltaic pile, which is in fact an apparatus for generating electrical out of chemical action. Far more difficult to detect are the relations of *Light* with the other forces of nature. We cannot say that light and heat are one, though the very same sunbeam contain them; for heat is often obscure, and light unaccompanied by the faintest trace of heat. But light when absorbed, when it disappears as light that is, manifests itself as heat. " The rays of heat differ from the rays of light," says Dr. Tyndall, " simply as one colour differs from another. As the waves which produce red are longer than those which produce yellow, so the waves which produce heat are longer than the red." That which we call light, then, " embraces an interval of rays of which the eye is formed to take cognisance," and heat might be described as light, of too low a pitch to be visible." But the red rays, intermediate between these two, combine the powers of both, and excite the sensation of light when falling on the retina, and of heat when falling on the nerves of sensation. Thus is each sense formed to catch its octave or two of the vast scale of visible and invisible vibrations which constitute the grand harmonies of nature. Light and chemical affinity are as closely, yet not indissolubly, blended in the sunbeam as light and heat. Those rays which most vividly excite the sensation of light are feeblest in actinic or chemical power; whilst the most active chemical rays are feebly luminous. Yet it may be safely said that light can exert chemical action, and through it initiate or pass into all the other modes of force.

A great principle not only leads on to the discovery of new truth, but casts so strong a light on all the error, vagueness, and insufficiency within its sphere, that it is no longer possible to rest satisfied with them, or to pause till clear and harmonious interpretations of fact have taken their place. In this manner has the principle of Conservation of Force led some of our highest scientific minds to a growing dissatisfaction with the hitherto received views of the Force of Gravitation. " There are signs that even Newton's axiom is not exempt from the restless law of progress," said Professor Owen in his address to the British Association the other year. It must not be for a moment thought that Newton's great law of gravitation is impugned. No! but a protest is entered against accepting that law, which gives account of one exercise of the force, as a full and satisfactory description of gravitation in its totality. For, says Faraday, our definition of gravity as an attractive force between the particles of matter, varying inversely as the square of the distance, implies that the mere fact of bringing near two bodies or particles *creates* an enormous force, and that their removal from one another *annihilates* the same. But, if force be truly as indestructible as matter, then this gravitating power must have some disguise as yet unpenetrated, some other mode of action, when by distance its gravitating power is suspended or diminished. " *Consequences must occur* equal in importance to the power suspended or hidden." Which consequences, involving the relations of gravity with the other forces, of nature, have yet to be discovered. Ten years ago, Faraday endeavoured (but with only a negative result) to establish by experiment a connexion between gravity and electricity. Mossotti, in a very remarkable paper on the Forces which Regulate the Internal Constitution of Bodies, referred to by all who have written on the subject of Conservation of Force, boldly shows *how* gravitation " may follow as a consequence from the principles which regulate the electric forces." He looks forward to the time when the mathematician shall achieve as great a triumph over that which is hidden from us by minuteness and subtlety, as he

has attained over that which seemed utterly beyond the grasp of man from vastness and remoteness. By the discovery of the laws of molecular action, he will be led to "establish molecular mechanism on a single principle, just as the discovery of the law of universal attraction led him to erect on a single "basis the mechanism of the heavens."

How, indeed, after reviewing the close relationship —the mutual interchangeableness—of the physical forces, is it possible to avoid the conclusion that (in Faraday's memorable words), they have all "one common origin, or rather, are different manifestations of one fundamental power?" And further, it would be hard to reconcile such views of the continuity and varied manifestation of force with the notion of vacuum—of direct action at a distance through a vacuum, that is—though such has hitherto been the usual idea of gravitation. It was not Newton's. He had a far profounder, and, so to speak, more modern idea of it than his successors, as his own emphatic words testify: "That gravity should be innate, inherent, and essential to matter," wrote he, "so that one body may act upon another at a distance, through a vacuum without mediation of anything else by and through which thier action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it." Empty space! it is a delusion. Between us and the sun, between us and the remotest star whose beams strike upon human eyes, there is no void. Though our senses are not so finely attuned as to catch so subtle a reality, we know that through that space comes to us force, light, actinism, heat, gravitation; and, the more earnestly man searches into the modes of action of these, the more impossible it becomes to conceive of their existence apart from matter, any more than that of matter apart from force. It is no novelty to us that matter should be invisible and intangible: not merely is the air we breathe so, but the most dense and solid rock may by the action of intense heat (as in the voltaic arc) pass into that condition. Why then may not matter of a far subtler and more ethereal kind than that of which our atmosphere is composed pervade the regions of space, conveying to us the sweet and mighty influences of sun and stars? Unhappily—yet not, perhaps, unhappily, for it compels boldness to go hand in hand with humility—the profounder the knowledge gained by the man of science of the workings of force and of the composition of matter, the more heavily the conviction presses on him that the true secret of both is beyond his grasp. An unthinking man will grant you readily enough that mind is an inscrutable mystery; but of matter he believes he has a very clear and adequate idea, little dreaming that of that idea one half only is perception, the other half conclusions from perception, which may be true or false. But the physical philosopher, long pondering, experimenting, measuring, testing these objects of our perceptions, comes more and more to distrust the received conclusions; nay, in many cases, to form entirely opposite ones, led especially by the subtle relations of the forces of nature with one another, and the mysterious and indissoluble connexion, perhaps identity (for so have Boscovich and Faraday been tempted to surmise) between matter and force. Whether man can do more than speculate concerning the nature of these—more than say what they are not, what they may be, but never what they are—whether the most piercing and aspiring intellect must in this direction only beat its wings against the bars, it is not for us to decide. At least it is a gain worth all the toil to recognise vividly that there *is* a deep mystery not only in that which lives and grows, but in the very stocks and stones. No longer mistaking our own shallow conceptions for complete and absolute truth, our minds may become as a clear unclouded mirror, where in dim and shadowy grandeur some suggestions of this far-off absolute truth will perhaps be reflected.

But to return to the definite and practical aims of science. Hitherto we have glanced at the indestructibility of force in the inorganic world. But the tie between organic and inorganic is so close, the organic being nourished and built up out of the inorganic, that we must look to find the same indestructible forces at work in the one as in the other, though under new conditions, and under the control of that higher agency which we call Vital Force. We take in force in the air we breathe, in the food we swallow. In decomposition these forces are set free, and find new scope for their activities. Hence it is that "decomposition is the handmaid of growth." That slow combustion, for instance, which is the source of animal warmth—the combining of the oxygen of the air with the inflammable constituents of food—witnesses to the continued activity of chemical force within us as without. Yet it must always be borne in mind that in the living organism chemical affinity is controlled and and often opposed (else how should organic differ from inorganic products?) by that wonderful power of which, knowing absolutely nothing, we speak vaguely as the vital force. As in the world around us heat may pass into motion, so does the mechanical work of the body bear a strict relation to the amount of fuel consumed in respiration. The experiments of Mateucci demonstrate that electricity also is a powerful agent in the internal economy of a living creature.

With yet stricter truth may the vegetable kingdom be said to be built up out of the inorganic; for here the process is a direct one, whereas in the animal it is for the most part *in*direct. Here too, then, the forces of the inorganic world work unceasingly. "To suppose," says Dr. Carpenter, "that all the forces that are concerned in the growth and nutrition of countless generations of oaks were slumbering in the one acorn from which they all sprung, is to suppose a pure absurdity. The forces which carry on vegetable life are derived from without; are, in fact, the forces of nature, heat, light, chemical affinity; and that which does exist in the germ and which is peculiar to organization—the vital force, in fact—is simply *directive* power." Words which, while they impress us by their boldness, seeming as it were to bridge over an abyss of ignorance, awaken again that painful sense of man's limitations; for in the expression "the vital force is directive power," we stretch out our hands towards a truth that for ever eludes us, and find ourselves grasping an empty garment of words. Though it be good to recognise this, it is not good to be daunted or discouraged. If God

has set a limit to the conquering power of man's intellect, He has left it for man himself to discover where that limit lies; left it to be discovered by the gifted and laborious, aided by "the long results of time," not to be predicted by the timid and indolent. It is not piety, but self-satisfied ignorance and cowardice, which makes a man shrink from pressing on into the dim unknown, and decry, as presumptuous and irreverent, those whose heaven-otsen impulse it is to do s.

These remarks might seem uncalled for at the present day, when science confessedly occupies so honourable a position. But there still lingers in the minds of the religious a tendency to view with distrust and suspicion its bolder flights. Why should this be? How can harm come of the faithful and earnest study of God's works, seeing that He has implanted both the faculty and aspiration to gain understanding of them? Perhaps there is even a touch of what has, with just severity, been called "that worst kind of infidelity, the fear lest the truth be bad," in this shrinking from a face-to-face encounter with some of the facts of nature, and the inevitable deductions from them. Conflicting opinions upon the wisest there may be, conflicting truths there cannot. If, therefore, science bring to light facts which seem to militate against that which we hold as high and sacred truth, we may rest calmly assured that a fuller knowledge of such facts, a deeper insight into their true bearings, will dispel the appearance of antagonism. But then we must go boldly on to reach this higher stage, not turn back and basely seek the dark shelter of ignorance. Or rather, the man of science goes boldly on for us. How ungenerous to reproach him for his boldness!

It cannot be denied that there is also in our highest literature a tone, not of open hostility, but of covert contempt for science. It is looked down upon as tending to materialism; and its devotees as men whose eyes, long scrutinizingly fixed upon the outward aspects of things, grow dim to all beyond; and who, in Wordsworth's memorably unjust words, "would peep and botanize upon their mother's grave." Does, then, a too curious searching into nature's works strip them of their beauty, their mystery? Does it tend to debase the heart and dull the imagination? Impossible. The beauty, the mystery, are not of such flimsy, shallow kind, as to vanish beneath an earnest questioning gaze. What it was worth God's while to make, it is surely worth man's while to understand. As to the charge of materialism, of course the business of physical science is with the material world. But if it have one decided tendency at the present day, it is to exalt and spiritualize our idea of matter, and, far from destroying, to enchance the sense of mystery. Why should literature treat science as men treat one another—each expecting in his neighbour all his own virtues added to all theirs, with the faults of both left out? Why, because it does not comprise all man seeks for of truth and knowledge, should he slight what it does? Rather should we honour the humblest labourer in the fields of science, and prize the fruits of his labour. What man is so rich in intellectual possessions that he can afford to despise the smallest fragment of truth? Nature has not denied legs to those creatures whom she has endowed with wings; neither can the soaring imagination wisely leave unvisited the solid ground of fact, whereon science is so notably extending her possessions. Like the birds, she must come down to feed if she would be strong on the wing.

Miscellaneous.

Albert Coal, or Albertite.

A beautifully lustrous, and intensely black substance is exhibited, under the name of Albert Coal, in the New Brunswick Court. It occurs at Hilsborough, Albert County, N. B. Albertite presents the general appearance of an excellent cannel-coal, and breaks with an extremely brilliant, conchoidal, vitreous fracture. Its jet black powder when heated in an open vessel, partially melts, and then gives off continuously a large volume of combustible vapour, leaving a light and bulky coke. This vapour burns with an intensely smoky flame. But there is one point to be noted here of considerable interest: the coke which Albert coal leaves is nearly pure carbon, there being in fact, speaking practically, no ash in Albertite, as the following result proves:—

1·55 grammes left ·001 of ash.

This is equal to no more than ·0645 per cent., which we believe that no cannel-coal or anthracite hitherto analysed contains so little as 1·0 per cent. of ash. Among its volatile constituents, Albertite contains scarcely determinable traces of nitrogen and sulphur.

Accompanying the Albert coal, there may also be found in the New Brunswick Court some very pure and pale-looking specimens of oil produced by its destructive distillation. As might be expected from the almost entire freedom of the mineral from nitrogen and sulphur, these oils are almost without offensive odour, and are, moreover, admieably adapted for burning in paraffin lamps. They are not capable of forming an explosive or inflammable vapour, and the light they give is brilliantly white.

A sample of oil submitted to fractional distillation did not commence to boil until the thermometer had risen to 170° C., while only half the oil had come over at 270° C., one-seventh or even more, remaining in the retort when it had been raised to the boiling point of mercury. This residue did not show any traces of crystals when cold.

It is to be regretted that the discovery of an abundant supply of native mineral oil has caused the manufacture of Albertite oil to be discontinued.

Specific Gravity of Oils.

Oils of different specific gravities are obtained from petroleum according to the temperature to which it is subjected during distillation. That which passes over at a temperature of 302° Fah., according to the experiments of Professor B. Silliman, junior, has a specific gravity of ·733 (three lower than sulphuric ether); that which has been obtained at 320° has a specific gravity of ·752; that at 338° Fah., ·766; at 392°, ·800; at 518° ·854, Pure alcohol has a specific gravity of ·815. As several eupion oils obtained from petroleum are lighter than alcohol, we can thus form a very correct idea of their volatile character.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

DECEMBER, 1862.

EARLY CANADIAN INDUSTRY.

Three hundred and twenty-seven years ago, Jacques Cartier, of St.Malo, discovered the St. Lawrence,* sailed up its mighty stream for several hundred miles, formed alliances with the Indians, built a fort, and wintered in the country. In 1540, the colonization of the newly discovered "Canada" was commenced under the auspices of Roberval, the first Viceroy, and an attempt made to establish a traffic in furs with the natives, but in consequence of the loss of Roberval and some of his companions at sea in 1549, and European distractions arising from the wars between France, Spain and Austria, no further effort was made for nearly half a century to colonize the valley of the St. Lawrence. In 1581, a trade with Canada began to spring into activity, and in 1591 a fleet of ships was fitted out by the adventurous inhabitants of St. Malo, to engage in the Canada trade, and chiefly to procure the teeth of the walrus, which at that time was common in the estuary and gulf of the St. Lawrence.

In 1603, a company of adventurers, headed by M. de Chauvin, Lieutenant General of Canada and Acadia, received a royal charter from Henry IV. of France, and established a regular system of trade in the colony. Ten years later, Champlain obtained a commission authorizing him to seize every vessel not holding a license he should find trafficking in furs between Quebec and the upper part of the St. Lawrence. In 1628, the celebrated but unscrupulous Cardinal de Richelieu organized the "Company of One Hundred Partners," and conceded to its members in perpetuity the Vice-Royalty of New France and Florida, thus establishing a commercial regime in Canada, whose influence soon extended far and wide among the Indian races of the valley of the St. Lawrence.

The "Company of One Hundred Partners" was dissolved by Louis XIV in 1663, who resumed the jurisdiction over the country which for 35 years had been under the rule of a trading association.

Scarcely, however, had a year elapsed, when, by a royal edict dated 1664, Canada was once more handed over to the short lived commercial bondage of the "West India Company," but, in 1666, free trade with the Aborigines was again declared, subject to certain restrictions and reservations. The Company was permitted to retain the right to one-fourth of all the beaver skins, and one-tenth of the elk hides exported, besides the traffic which belonged to Tadoussac at the mouth of the Sauguenay. For these privileges the Company paid 48,950 livres, or about 10,000 dollars, a livre being worth at that period about one English shilling. Thus far the efforts made by the French to colonize Canada and open a trade with the different Indian nations inhabiting the vast extent of country drained by the St. Lawrence, had not been productive of much public or private good, and was marked by a succession of individual disasters, which damped the ardour even of the most courageous and enterprising merchants of that day.

Lake Superior was visited, in 1659, by two traders, who joined some roving bands of Algonquins and passed the winter in that region. In 1660 they returned to Quebec, escorted by sixty Algonquin canoes laden with furs.

In the autumn of 1678, La Salle, armed with a royal commission, commenced the construction of a fort at Niagara, and during the winter he laid the keel of a vessel intended for the navigation of the upper lakes, about six miles above the stupendous cataract. The first Upper Canadian ship (for in those days it was worthy of that designation) was launched in the summer of the following year, and, to the unbounded astonishment and alarm of the savage Iroquois and Eries who peopled either shore, it sailed through Lake Erie, through Lake Huron, and finally reached Lake Michigan. The "Griffon," as the vessel was called, met with an untimely fate on the return; she was wrecked before she reached the Niagara river, and with her rich cargo of furs sank beneath the waves of the inland sea whose solitudes she was the first to invade. Not two centuries (183 years) after the lonely "Griffon" had penetrated through the Upper Canadian lakes, the commerce of the region tributary to them was more than sufficient to employ nearly two thousand steamers and sailing vessels, exceeding half a million tons burthen and costing fifteen millions of dollars.*

Subsequently to the extinction of the West India Company, the trade in peltries was free for a time, with the exception of beaver and elk skins, for which monopoly 70,000 francs a year was paid by the lessees, until it became the property of a French Society called the "Company of Canada." After

* In 1508, one Thomas Aubert made a voyage from Dieppe to Newfoundland, and sailed up the estuary of the St. Lawrence.

* The Marquis de Denonville, in a proclamation respecting the taking of the post, Niagara, in 1687, states that the stocks on which La Salle built his "bark" were still seen above the great lake, and that his "quarters" were burned in 1675 by the Senecas He also states that the Sieur de la Salle navigated Lake Erie Huron and Illinois (Michigan) for several years.

an unprosperous existence for a few years, this trading association, like its predecessors, expired deeply in debt in 1706. In a report on the condi tion of Canada in 1715, contained in the "*Documents de Paris,*" there is an interesting account of colonial affairs, which throws some light on the state of Canada at that period. The report is by M. d'Auteuil, who remarks that trade with the savages, once considerable, had even at that early date greatly fallen off. Ship building was brisk even 150 years ago; hemp for cordage and flax for linen were advantageously grown, but France did not import Canadian timber, or continue to work the copper mines on Lake Huron. The French, at the close of the 17th century, must have been familiar with the copper treasures of the shores of Lake Huron and perhaps even Superior, or M. d'-Auteuil would not have regretted their neglect of them. In 1687, M. de Denonville writes to the French Minister,* "The copper, of which I sent a sample to M. Arnon, is found at the head of Lake Superior. The body of the mine is not yet discovered. I have seen one of our voyageurs, who assures me that he saw, fifteen months ago, a lump 200 lbs. weight, as yellow as gold, in a river which falls into Lake Superior. When heated, it is cut with an axe, but the superstitious Indians, regarding this piece as a good spirit, would never permit him to take any of it." The estimate formed by M. d'Auteuil of the annual value of the peltries exported from Canada in 1677 was 550,000 francs, and, in 1715, two million francs. Thos. Dongan, governor of the province of New York, in 1687, complains bitterly of the difficulties he had to encounter in finding on his arrival in the colony "such a contest between the government of Canada and this (New York), about the beaver trade, the Inland country, and the Indians." The English found their way to Lakes Ontario and Erie with merchandise, for barter with the Ottawa Indians, as early as 1686, much to the disgust of M. de Denonville, who writes to his government that he is going to intercept ten English canoes, laden with merchandise, who have appeared on Lakes Ontario and Erie. "I regard, my lord," he says, "as of primary importance the prohibition of the trade to the English, who without doubt would entirely ruin ours, both by the cheaper bargains they could give the Indians, and by attracting to them the Frenchmen of our colony, who are accustomed to go to the woods."† The "merchandise" largely employed in those days, and continued up to the present time, both by British and French, has proved the ruin of the Indian race on this continent. M. de Denonville writes to Governor Dongan, "Think you, sir, that religion will progress whilst your merchants supply, as they do, *eau de vie* in abundance, which converts the savages, as you ought to know, into demons, and their cabins into counterparts and theatres of hell." But what was the religion spoken of by Denónville? Here is a description of it. "The present is to inform Y. R. of our return from the Iroquois Mission, loaded with some spoils rescued from hell. We bear in our hands more than five hundred children and a number of adults, the most part of whom died in baptism. We have re-established faith and piety in the heart of a poor Captive Church, the first foundations of which we laid in the Huron country. We have proclaimed the gospel unto all the Iroquois nations, so that they are henceforth without excuse, and God will be fully justified against them at the great day of judgment.*

* Paris Doc. 1686. † Paris Doc. 1687.

In a memoir addressed to the Marquis of Seignelay, dated 1687 (Paris Doc.), the trade of Canada is described as being very precarious. "Canada is encompassed by many powerful English colonies, who labour incessantly to ruin it by exciting all our savages and drawing them away with their peltries, for which the English give them a great deal more merchandise than the French, because they pay no duty to the King of England.†

In 1754, only ten vessels, of 40 to 100 tons, were built in Canada. The trade with France employed about thirty ships, belonging to merchants of La Rochelle. During the administration of French rule previously to the year of peace 1760, when Montreal and all the French fortresses in Canada were surrendered to Great Britain, the balance of trade was always against the colony.

The exports previous to 1759 are stated in a prosperous year to have been as follows :

Furs to the value of	£88,333	stg.
Seal oil..........................	10,416	"
Flour and pease	10,416	"
Timber	6,250	"
Total	£115,415	"

* Father Paul Ragueneau.

† Governor Dongan's reply to M. de Denonville is characteristic of that officer. "The missionary fathers, if they please but do me justice, can give you an account how careful I have been to preserve them, I have ordered our Indians strictly not to exercise any cruelty or insolence against them, and have written to the King, my master, who has as much zeal as any prince living to propagate the Christian faith, and assure him how necessary it is to send to them some Fathers to preach the gospel to the Natives allied to us, and care would then be taken to dissuade them from their drunken debouches, though certainly our rum doth as little hurt as your brandy, and in the opinion of Christians is much more wholesome; however, to keep the Indians temperate and sober is a very good and christian performance, but to prohibit them all strong liquors seems a little hard and very Turkish."
Paris Doc., III.

In 1729, the annual expenditure of the government of Canada was £16,166 13s. 4d.; in 1759, the disastrous year which witnessed the fall of Quebec, the expenditure rose to £1,083,330 6s. 8d. stg., but this vast outlay did not increase the trade of the country, Military operations, glory and extravagance, consuming it all. In 1751, the number of vessels engaged in foreign trade with the Colony only amounted to fifty-three, bearing a total importation valued at £216,769, and an exportation valued at £75,560, leaving a balance against the Colony of £141,209 sterling.

After the fall of Quebec, trade increased and assumed a healthy tone; the imports no longer exceeded the exports; another race less addicted to military glory acquired a standing in Canada, and began to develope its long neglected resources. But the country people, of French origin, had received an indelible impress of character and disposition which they have retained in many particulars up to the present day.

Discoveries at Pompeii.

Under the government of the Neapolitan Bourbons, it was the custom to unearth a house at Pompeii on the occasion of a visit from some illustrious guest of the king. The visitor was allowed to pay the expences of the honour conferred upon him. A fear was entertained that if all the buried treasures of the city were at once exposed, all interest in the discoveries would gradually die out, and " strangers' money " would soon be wanting to gladden the eyes of Neapolitans. Moreover, if the work had been at once completed, the king must of necessity have paid the expenses, Thus by spreading it over a number of years, the appetite for antiquities was fed but never satiated, and the cost of entertainment did not tax the king's pocket. The " Ré Galantuomo " does not, it appears, act on this shabby system, for we hear that no less than three houses have within the last month been exposed to view. One is of unusual extent and magnificence, and is enriched with wall paintings of rare design and workmanship. It forms another illustration of the 6th book of Vitruvius, wherein the domestic architecture of the Romans is so minutely described, and recalls Pliny's account of the luxury and splendour in which the more favoured citizens indulged; but neither Crassus, Pollio, or Lucullus, would ever have placed "Salve Lucrum, " as we find the ashed-out owner of the latest discovered villa has done, upon his very door step. We have heard already of " salve " and of " cave canem, " and we have seen them repeated upon English door-mats, but the new inscription will have, we fancy, no duplicates made of it.

The other discovery is a baker's shop, which has, of course, been closed for nearly 2,000 years, but in which everything has remained in such order that the baker might be supposed to have just left it, and might be momentarily expected to return and resume his vocation.—*Building News.*

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The following is an abstract of Mr. Glaisher's paper on the recent balloon ascents.

All philosophical inquiries carried on or near the surface of the earth are of necessity fully within its influence, and consequently within the influence of many disturbing causes. By no other means than the use of the balloon can we free ourselves from these disturbing influences. Let us consider what sciences might be thereby benefited—chemistry probably, magnetism certainly, and meteorology and astronomy. When we regard the influence which a clear sky or a cloudy one exercises upon the temperature, and so upon our comfort and well-being generally, we see the importance of cultivating an acquaintance with the higher regions, and increasing our knowledge with aerial phenomena. I will now state the object of the experiments which have been instituted. The committee charged me with two primary objects. 1. Determination of the temperature of the air and its hygrometric state at different elevations up to five miles. The secondary objects were, to compare the readings of an aneroid barometer with those of a mercurial barometer; to determine the electrical state of the air; to determine the oxygenic conditions of the atmosphere by means of ozone papers; to determine the time of vibration of a magnet on the earth and at different distances from it; to determine the temperature of dew-point by Daniell's dew-point hygrometer and Regnault's condensing hygrometer, and by the use of the dry and wet bulb thermometers as ordinarily used, and by their use, when under the influence of the aspirator, to collect air at different elevations; to note the height and kind of clouds, their density and thickness, at different elevations; to determine the rate and direction of different currents in the atmosphere; to note atmospherical phenomena; and to make general observations. The ascents were all made by Mr. Coxwell's large balloon, three of them from Wolverhampton, four from the Crystal Palace, Sydenham, and one from Mill Hill, near Hendon, where the balloon had fallen the night previously. The first ascent was from Wolverhampton, on 17th July last. Owing to the force of the wind considerable difficulty was experienced in the preliminary arrangements, and I was unable to place a single instrument in its position before starting. The ascent took place at 9·43 a.m., and at once the balloon was quiescent. The degree of tranquillity experienced was remarkable, considering that but a few minutes had elapsed since the balloon was agitated. The swaying to and fro had ceased in an instant, and I at once proceeded to fix the instruments. At the height of 4,000 feet we entered a stratum of clouds of nearly a mile in thickness. A height of more than 10,000 feet had been passed before I could put all the instruments in working order. The sky was of a deep Prussian blue colour, without a cloud of any kind upon its surface. At starting, the temperature of the air was 59°; at 4,000 feet, 45°, and descended to 26° at 10,000 feet, and then there was no variation of temperature between this height and 13,000 feet. During the time of passing through this space, Mr. Coxwell and myself both

put on additional clothing, feeling certain that we should experience a temperature below zero before we reached an altitude of five miles; but, to my surprise, at the height of 14,500 feet, the temperature, as shown by all the sensitive instruments, was 31°, and at each successive reading up to 19,500 feet the temperature increased, and was here 43°. When we had fallen somewhat, the temperature again began to decrease, and with extraordinary rapidity, and was 16° or 27° less than it was 26 minutes before. At this time, about eleven a.m., we were at a height of five miles. When the balloon had attained a height of four miles, I wished to descend for one or two miles, and then to reascend; but Mr. Coxwell felt certain we were going too near the Wash to enable us to make a dip and then reascend. Our descent began a little after eleven, Mr. Coxwell experiencing considerable uneasiness at our too close vicinity to the Wash. We came down quickly, passing from a height of 16,300 feet to one of 12,400 between 11·38 and 11·39. Immediately afterwards we entered a dense cloud, which proved to be no less that 8,000 feet thick, and in passing through which the balloon was invisible from the car. Mr. Coxwell had reserved a large amount of ballast, which he discharged as quickly as possible to check the rapidity of the descent. However, we came to the earth with a very considerable shock, which broke all the instruments which I had been unable to pack up. The descent took place at Langham, near Oakham. The first ascent from the Crystal Palace took place on the 30th of July. The balloon left the earth at 4·40 p.m. The temperature declined instantly. A height of 7,000 feet was reached at about six o'clock, and the descent began about 6·15. It was rather rapid, but quite under control, and we reached the earth at Singlewell, near Gravesend, at 6·30. Another ascent was made from Wolverhampton on August 18. In about ten minutes we psssed through a fine cumulus cloud, and then emerged into a beautiful clear sky, dotted over with cirrous clouds. The descent was made when we had reached an altitude of 24,000 feet. We reached the earth at Solihull, about seven miles from Birmingham. The second ascent from the Crystal Palace took place on the 20th of August. The balloon started at 6·26 p.m. At 6·37 the height of three-quarters of a mile was attained, and the air was so tranquil that we were still over the Palace. At 6·43, when at the height of nearly a mile, we passed through a thick mist, the earth being just visible. We continued for a time at this elevation, and then descended 200 or 300 feet. We kept at this height till 7·2, when Kennington Oval was in sight. At 7·9 St. Mark's Church, Kennington, was exactly underneath us. The hum of London was heard, and there was scarcely a breath of air stirring. We then descended gradually, and at 7·12 the lamps were being lighted over London, and the hum of the great city increasing in depth. At 7·20 shouting was heard of people below who saw the balloon. At 7·40 Mr. Coxwell determined to ascend above the clouds, and at 7·47 we were nearly a mile high, the temperature being 45 deg. We still ascended till the clouds were below us tinged with a rich red. At 7·52 the striking of a clock and the tolling of a bell were heard. It was quite dark below, but the sun tinged the tops of the clouds. At 8·5 we were above the clouds, and it became light again, and the hum of London died gradually away. After this we descended, and London was again seen, but it now presented the appearance of a conflagration of enormous extent, the sky being lit up for miles around. We descended in the centre of a field at Mill Hill, about a mile and a half from Hendon, and it was resolved to anchor the balloon here for the night, with the view of making an early morning ascent. By half-past four a.m. we again left the earth. There were in the car, besides Mr. Coxwell and myself, Captain Percival and my son. At 4·53 we were above a mile high; we were just entering a cloud. At 4·57 we were in cloud, surrounded by white mist. The light rapidly increased, and gradually we emerged from the dense cloud into a basin surrounded by immense black mountains of cloud far above us, and shortly afterwards we were looking into deep ravines of grand proportions, bounded with beautiful curved lines. By 5·31 we were somewhat less than three miles high, at which elevation we continued about half an hour. During our descent I noticed the loud ticking of a watch. Captain Percival said he could not hear it. He was seated and I was standing, and after some experiments were made, it was found that when the ear was on the same level as the watch no sound was heard, but it became remarkably distinct on the ear being situated above it. At the height of two miles the barking of a dog was heard. We gently reached the ground at Dunton Lodge, near Biggleswade. On the 1st September another ascent was made from the Crystal Palace. The wind was E.N.E., the sky was almost covered with cirrostratus cloud, the horizon was moderately clear. The ascent took place at 4·40 p.m. The balloon rose to the height of half a mile in four minutes. At this time the whole of the river Thames from beyond Richmond was in sight. At 5·31, when we were about 4,000 feet high, clouds had formed following the whole course of the Thames from the Nore up to the higher parts of the river, and extending but little beyond its sides. The clouds were parallel to the river, following all its windings and bendings. At this time it was about high water at London Bridge, so that the formation of the clouds is connected with the warm water from the sea. The balloon fell at 6·15 near Woking. The most important ascent took place from Wolverhampton on Sept. 5. It commenced at 1·3 p.m. The temperature of the air was 59°, at the height of one mile it was 39°, and shortly afterwards we entered a cloud of about 1,100 feet in thickness, in which the temperature fell to 36½°, and the air was saturated with moisture. We reached two miles in height at 1·21, three miles at 1·28, and four miles at 1·39. In ten minutes more we had reached the fifth mile, and the temperature had passed below zero, and then read minus 2°. Up to this time I had taken observations with comfort. I had experienced no difficulty in breathing, whilst Mr. Coxwell, in consequence of the necessary exertions he had to make, had breathed with difficulty for some time. Mr. Coxwell ascended into the ring, and I endeavoured to reach some brandy which was lying on the table, at a distance of about a foot from my hand, but I was unable to do so. My sight became dim. I looked at the

barometer and saw it between 10 and 11 inches, and tried to record it, but was unable to write. I then saw it at ten inches, still decreasing fast, and just managed to note it in my book; its true reading therefore, was about 9¾ inches, implying a height of about 29,000 feet. I was losing all power and endeavoured to rouse myself by struggling and shaking. I essayed to tell Mr. Coxwell I was becoming insensible, but I had lost the power of speech. I saw Mr. Coxwell dimly in the ring; it became more misty, and finally dark. I was still conscious, and knew I should soon be insensible, and I suddenly sank, as in sleep. On recovering consciousness I heard Mr. Coxwell say, "What is the temperature? Take an observation; now, try." I could neither see, move, nor speak, but I knew he was in the car trying to rouse me. I then heard him speak more emphatically, "Take an observation. Now, *do* try." I then saw the instruments dimly, and Mr. Coxwell very dimly, then more clearly, and shortly afterwards said to Coxwell, "I have been insensible," and he replied "You have, and I nearly." I recovered somewhat quickly, and Mr. Coxwell said "I have lost the use of my hands; give me some brandy to bathe them." His hands were nearly black. I saw the temperature was still below zero, and the barometer reading 11 inches, and increasing quickly. I resumed my observations at 2·7, recording the barometer reading 11·53 inches, and the temperature minus 2°. I then found that the water in the vessel supplying the wet bulb thermometer which I had by frequent disturbance kept from freezing, was one mass of ice. Mr. Coxwell then told me that whilst in the ring he felt it piercingly cold; that hoar frost was all round the neck of the balloon, and on attempting to leave the ring he found his hands frozen, and he had to place his arms on the ring and drop down; that he found me motionless, with a quiet and placid expression on the countenance, that he at first thought I was resting myself; that he then spoke to me without eliciting a reply, and then observed my arms hanging by my side, and my legs extended, and found I was insensible. He then felt that insensibility was coming over himself, and that he could not assist me in any way; that he became anxious to open the valve; that his hands failed him, and that he instantly seized the line between his teeth and pulled the valve open two or three times, until the balloon took a decided turn downwards. This act is quite characteristic of Mr. Coxwell. I have never yet seen him without a ready means of meeting every difficulty as it has arisen with a cool self-possession that has always left my mind perfectly easy, and given to me every confidence in his judgment in the management of so large a balloon. Six pigeons were taken up. One was thrown out at the height of three miles, it extended its wings and dropped like a piece of paper; a second at four miles flew vigorously round and round, apparently taking a dip each time. A third was thrown out between four and five miles and it fell downwards. A fourth was thrown out at four miles when descending; it flew in a circle and shortly alighted on the balloon. The two remaining pigeons were brought down to the ground. One was found dead, and the other, a carrier, had attached to its neck a note. It would not, however, leave, and when cast off the finger returned to the hand. After a quarter of an hour it began to peck a piece of ribbon by which its neck was encircled, and it was then jerked off the finger, and it flew with some vigour finally towards Wolverhampton. One of the carriers returned to Wolverhampton on Sunday, and this is the only one we heard of. We descended in the centre of a large meadow belonging to Mr. Kersmall, at Cold Weston, seven miles and a half from Ludlow. The last ascent was from the Crystal Palace, on the 8th of September. We fell about four miles from Tilbury Fort. These eight ascents have led me to conclude—firstly, that it was necessary to employ a balloon containing nearly 90,000 cubic feet of gas, and that it was impossible to get so high as six miles even with a balloon of this magnitude, unless carburetted hydrogen, varying in specific gravity from 370 to 340, had been supplied for the purpose. It is true that these statements are rather conflicting when compared with the statements made by one or two early travellers who professed to have reached some miles in height with small balloons. But if we recollect that at three miles and three-quarters high a volume of gas will double its bulk, we have at once a ready means of determining how high a balloon can go, and in order to reach an elevation of six or seven miles it is obvious that one-third of the capacity of the balloon should be able to support the entire weight of the balloon, inclusive of sufficient ballast for the descent. The amount of ballast taken up affords another clue as to the power of reaching great heights. Gay Lussac's ballast was reduced to 33 lb. Rush and Green, when their barometers, as stated by them, stood at 11, had only 70 lb. left, and this was considered a sufficient playing power. We found that it was desirable to reserve 500 or 600 lb., and although we could have gone much higher by saving less, still on every occasion it was evident that a large amount of ballast was indispensable to regulate the descent and select a favourable spot with the nicest accuracy. Secondly, it was manifest throughout our various journeys that excessive altitude and extended range as to distance are quite incompatible. The reading of the instruments establishes this, and it has been pointed out what a short time the balloon held its highest place, and how reluctantly it appeared to linger, even at a somewhat less elevation. It has been stated by an aeronaut of experience that strong opposing upper currents have been heard to produce an audible contention, and to sound like the roaring of a hurricane. Now the only deviation we experienced from the most perfect stillness was a slight whining noise in the netting, and this only when the balloon was rising with great rapidity. The balloon itself as it descends flaps about occasionally, but this occurs when it is in a collapsed state, and very likely it was under similar circumstances, and perhaps during a rapid descent, that the flapping of the lower part of the balloon was mistaken for a roaring wind. I may also say that the too readily accepted theory as to prevalence of a settled west or north-west wind was not confirmed in our trips, nor was the appearance of the upper surface of the clouds such as to establish the theory that the clouds assume a counterpart of the earth's surface below, and rise or fall like hills or dales. The formation of vapour along the

course, and sinuosities during an ascent, from the Crystal Palace, was a very remarkable demonstration. The principal conclusions adduced from these observations may be briefly stated:—That the temperature of the air does not decrease uniformly with the height above the earth's surface, and that consequeutly more elucidation upon this point is required, particularly in its influence on the law of refraction. That an aneroid barometer can be made to read correctly, certainly to the first place and probably to the second place of decimals, to a pressure of so low as five inches. That the humidity of the atmosphere does not decrease with the height with a wonderful increasing ratio. That at heights exceeding five miles, the amount of aqueous vapour in the atmosphere is very small. That we now can answer the question I put in my opening remarks, and can say that observations up to three miles high even of a delicate nature can be made as completely in the balloon as on the earth; that at height exceeding four miles they cannot be made quite so well because of the personal distress of the observer; that at five miles high it requires the exercise of a strong will to make them at all. That up to three miles high any person may go into the car of a balloon who has any ordinary degree of self-possession. That no one with heart-disease or pulmonary complaints should attempt four miles high. But at the same time it must be borne in mind that I am concluding that the balloon is properly handled. It has been fortunate for the association and myself that we have had the assistance of Mr. Coxwell. He has the experience of more than 400 ascents, based upon knowledge of natural philosophy, and knows the why and because of all his operations; and it was this fact, which I saw immediately from the clearness of his explanations to me for each operation, that enabled me to dismiss from my mind all thoughts of my position, and to concentrate my whole energies upon my duties. In conclusion, I feel certain that if these experiments from the balloon are available for philosophic research one of the brightest links in the long chain of useful works performed through the agency of the association will be the proving that the balloon, in proper hands, may be made a powerful philosophic agent.

EXTENT, CHARACTER, RESOURCES, &c., OF THE BRITISH NORTH AMERICAN PROVINCES AND POSSESSIONS, AND CLIMATE OF THE INTERIOR.

The great and practical value of the British North American Provinces and possessions is seldom appreciated. Stretching from the Atlantic to the Pacific ocean, they contain an area of at least 3,478,380 square miles—more than is owned by the United States, and not much less than the whole of Europe, with its family of nations. No small portion of British territories consists of barren and inhospitable regions in the extreme north; but as a recompense, the arid plains extending through Texas, and thence northward beyond the limits of the United States, are comparatively insignificant as they enter the British Possessions, where the Rocky mountains are less elevated and have a more narrow base. The isothermal line of 60° for summer rises on the interior plains of this continent as high as the sixty-first parallel, its average position in Europe: and a favourable comparison may also be traced for winter and the other seasons of the year. Spring opens almost simultaneously on the vast plains reaching from St. Paul's to the Mackenzie river—a distance northerly of about 1,200 miles, Westward from these regions—now, scarcely inhabited, but of incalculable value in the future—are countries of yet milder climate, on the Pacific slope and in Vancouver's Island, whose relations to California are already important. On the eastward, but yet far distant from other abodes of civilization, are the small settlements enjoying the rich lands and pleasant climate of the Red River of the North, a stream capable of steamboat navigation for four hundred miles.

It is asserted by those who add personal knowledge of the subject to scientific investigation, that the habitable but undeveloped area of the British possessions westerly from Lake Superior and Hudson's Bay comprises sufficient territory to make twenty-five States equal in size to Illinois. Bold as this assertion is, it meets with confirmation in the isothermal charts of Blodgett, the testimony of Richardson, Simpson, Mackenzie, the maps published by the government of Canada, and the recent explorations of Professor Hind, of Toronto.

North of a line drawn from the northern limit of Lake Superior to the coast at the southern limit of Labrador exists a vast region, possessing in its best parts a climate barely endurable, and reaching into the Arctic regions. This country, even more cold, desolate, and barren on the Atlantic coast than in the interior latitudes, becoming first known to travellers, has given character in public estimation to the whole north.

Another line, drawn from the northern limit of Minnesota to that of Maine, includes nearly all the inhabited portion of Canada, a province extending opposite the Territory of Dacota and State of Minnesota, Wisconsin, Michigan, Ohio, Pennsylvania, New York, Vermont, New Hampshire. and Maine, possessing a climate identical with that of our northern States.

The "Maritime Provinces" on the Atlantic coast include New Brunswick, Nova Scotia, Prince Edward's Island and Newfoundland. Geographically they may be regarded as a northeasterly prolongation of the New England system. Unitedly they include an area of at least 86,000 square miles, and are capable of supporting a larger population than that at present existing in the United States or Great Britain. They are equal in extent to the united territory of Holland, Greece, Belgium, Portugal, and Switzerland.

New Brunswick is 190 miles in length and 150 in breadth. Its interests are inseparably connected with those of the adjacent State of Maine. It has an area ot 22,000,000 acres, and a sea-coast 400 miles in extent and abounding in harbors. Its population some years ago numbered 210,000, whose chief occupations are connected with ship-building, the fisheries, and the timber trade. Commissioners appointed by the government of Great Britain affirm that it is impossible to speak too highly of its climate, soil, and capabilities. Few countries are so well wooded and watered.

On its unreclaimed surface is an abundant stock of the finest timber; beneath are coal fields. The rivers, lakes, and sea-coast abound with fish.

Nova Scotia, a long peninsula, united to the American Continent by an isthmus only fifteen miles wide, is 280 miles in length. The numerous indentations on its coast form harbors unsurpassed in any part of the wourld. Including Cape Breton, it has an area of 12,000,000 acres, Wheat and the usual cereals and fruits of the northern States, flourish in many paats of it. Its population in 1851 was declared by the census to be 276,117. Besides possessing productive fisheries and agricultural resources, it is rich in mineral wealth, having beneath its surface coal, iron, manganese, gypsum, and gold.

The province of Prince Edward's Island is seperated from New Brunswick and Nova Scotia by straits only nine miles in width. It is crescent-shaped, 130 miles in length, and at its broadest part is 34 miles wide. It is a level region, of a more moderate temperature than that of Lower Canada, and well adapted to agricultural purposes. Its population in 1848 was 62,678.

The Island of Newfoundland has a sea-coast 1,000 miles in extent. It has an area of 23,040,000, acres, of which only a small portion is cultivated. Its spring is late, its summer short, but the frost of winter is less severe than in many parts of our own northern States and territories. It is only 1,665 miles distant from Ireland. It possesses a large trade with various countries, including Spain, Portugal, Italy, the West Indies, and the Brazils. The chief wealth of Newfoundland and of the Labrador coast is to be found in their extensive and inexhaustible fisheries, in which the other Provinces also partake. The future products of these, when properly developed by human ingenuity and industry, defy human calculation. The Gulf Stream is met near the shores of Newfoundland by a current from the Polar basin, vast deposits are formed by the meeting of the opposing waters, the great submarine islands known as "The Banks" are formed, and the rich pastures created in Ireland by the warm and humid influences of the Gulf Stream are compensated by the "rich sea-pastures of Newfoundland." The fishes of warm or tropical waters, inferior in quality and scarcely capable of preservation, cannot form an article of commerce like those produced in inexhaustible quantities in these cold and shallow seas. The abundance of these marine resources is unequalled in any part of the globe.

Canada, rather a nation than a province, in any common acceptation of the term, includes not less than 346,865 square miles of territory, independently of its Northwestern Possessions not yet open for settlement. It is three times as large as Great Britain and Ireland, and more than three times as large as Prussia. It intervenes between the great Northwest and the Maritime Provinces, and consists chiefly of a vast territorial projection into the territory of the United States, although it posesses a coast of nearly 1,000 miles on the river and gulf of the St. Lawrence, where fisheries of cod, herring, mackerel, and salmon are carried on successfully. Valuable fisheries exist also in its lakes. It is rich in metallic ore and in the resources of its forests. Large portions of its territory are peculiarlv favourable to the growth of wheat, barley, and the other cereals of the north. During the life of the present generation, or the last quarter of a century, its population has increased more than four-fold, or from 582,000 to 2,500,000.

The population of all the provinces may be fairly estimated as numbering 3,500,000. Many of the inhabitants are of French extraction, and a few German Settlements exist; but two-thirds of the people of the Provinces owe their origin either to the United States or to the British islands, whose language we speak, and who "people the world with men industrious and free."

The climate and soil of these Provinces and Possessions, seemingly less indulgent than those of tropical regions, are precisly those by which the, skill, energy, and virtues of the human race are best developed. Nature there demands thought and labor from man, as conditions of his existence, but yields abundant rewards to wise industry. Those causes which, in our age of the world, determine the wealth of nations are those which render man most active; and it cannot be two often or two closely remembered in discussing subjects so vast as these, where the human mind may be misled if it attempts to comprehend them in their boundless variety of detail, that sure and safe guides in the application of political economy, and to our own prosperity, are to be found in the simple principles of morality and justice, because they alone are true alike in minute and great affairs, at all times and in every place.

They imply freedom for ourselves, and those rules of fraternity or equality which enjoin us to regard our neighbours as ourselves. We can trust in no other policy.—*From the Report of the Committee on Commerce, on the Reciprocity Treaty with Great Britain, House of Representatives, U. S.*

Board of Arts and Manufactures

FOR UPPER CANADA.

JOURNAL OF THE BOARD OF ARTS AND MANUFACTURES FOR 1863.

In consequence of the rapidly increasing list of subscribers to this Journal, the Board have determined to reduce the price of the subscription for 1863 to a uniform rate of 50 cents. The number of copies now circulated monthly has risen to over 1200, and it is expected that the issue of 1863 will be 2,000.

At a time when the proprietors of most other monthly or weekly publications are increasing the price of their subscription, the *Journal of the Board of Arts and Manufactures for Upper Canada* is reducing its price one half, or from one dollar per annum to FIFTY CENTS.

The attention of Manufacturers, Patentees, and others, are respectfully directed to the following notices:—

TO PUBLISHERS AND AUTHORS.

Reviews and Notices of Books will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Editor, or to the Secretary of the Board.

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communication relating to industry and Manufactures will receive careful attention and reply.

TO MANUFACTURERS AND MECHANICS IN CANADA.

Statistics, hints, facts, and notices of new discoveries, are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside

ERRATA

Page 260, 13 lines from the bottom, 1st column—strike out the words *"exclusively of Canadian growth."*

Page 321, 3rd line from bottom of the 2nd column—for " as during the first trial," read " during the second hour of trial."

Page 323, 2nd column, 9 lines from bottom—for "carbonic acid," read "carbonic oxide."

"THE OIL CITY REGISTER."

A valuable weekly, published at Oil City, Venango County, Pennsylvania, and devoted to the interests of the Venango Oil Region. This paper always contains much valuable information respecting the American Oil Region, and whatever belongs to Petroleum, and the vast interests now dependent upon that material. Its terms are only one dollar a year, payable in advance.

PETROLEUM GAS—THE ST. NICHOLAS HOTEL, NEW YORK.

The subjoined certificate has been presented to Mr. Thomson, of this city, by the Proprietors of the St. Nicholas Hotel, New York, on the occasion of the introduction into that establishment of the new patented process for the manufacture of illuminating gas from petroleum.

The St. Nicholas Hotel is one of the largest in the world, and is well known both on this continent and in Europe. The proprietors state in their certificate, that the daily consumption of gas supplied by the Manhattan Company is 36,000 feet in the month of October, which is taken as representing the average of the year. The cost of 36,000 feet per day is $90, at $2 50 a thousand feet, so that the annual cost of lighting this establishment with the Manhattan Company's gas would amount to $32,850 a year. The annual saving resulting from the use of petroleum gas, even when crude petroleum is at 50 cents a gallon, amounts to more than $16,000; and if petroleum can be supplied at 20 cents a gallon, an extreme price in many parts of the United States and Canada, the saving will reach the large sum of $24,000 per annum, according to the statement of the proprietors of the St. Nicholas, as contained in the subjoined certificate. By a process, which it is not thought advisable to publish at present, but which has already been put in actual operation in New York, the petroleum gas can be furnished of any desired illuminating power, from the equivalent of 36 candles downwards. In order to make this statement familiar to the uninitiated in gas illumination, it is necessary to remind the reader that the illuminating power of coal gas is universally expressed photometrically, in standard wax candles. The gas supplied to the St. Nicholas was examined at the Manhattan Gas Works, by Dr. Torrey and Dr Wolcott Gibbs, from a sample conveyed to the laboratory of the company in a portable gas holder. The following is the report of Dr. Wolcott Gibbs, addressed to G. W. des Vœux, Esq., who undertook to have the photometric examination and analysis made:

Sir,—Agreeably to your request, I have examined the petroleum gas prepared by the process under Thomson's patent, and now exclusively used at the St. Nicholas Hotel. The illuminating power of the gas, as determined by photometric experiments, made in the laboratory of the Manhattan Gas Works, with excellent apparatus, was found to be equal to 27.48 standard candles; the illuminating power of the coal gas used in this city being from thirteen to nineteen standard candles, and averaging about sixteen.

The petroleum gas burns with a clear white light. On analysis it was found to contain

Hydrocarbons, condensible by bromine......	18.00
Carbonic oxide......	3.00
Carbonic acid	2.00
Hydrogen and other gases	77.00
	100.00

The quantity of carbonic acid is probably a little too high; the proportion of volatile hydrocarbons is nearly three times as large as in ordinary coal gas, and indicates a gas of unusual richness in illuminating constituents. The best and most economical methods of burning the petroleum gas, so as to obtain the greatest illuminating power with the least consumption of gas, are still to be determined; but I can cheerfully bear witness to the excellent quality of the gas, and to the simplicity and efficiency of the apparatus employed in its manufacture.

Your obedient servant,
WOLCOTT GIBBS.

New York, December 9, 1862.

The foregoing analysis, satisfactory as it is, refers only to the quality of the gas manufactured for the St. Nicholas Hotel. With the addition of a proper lime purifier, the whole of the carbonic acid will be abstracted, and as it is well known that the illuminating power of gas is diminished 6 per cent. for each 1 per cent. of carbonic acid it contains, the actual standard value of the gas supplied to the St. Nicholas will be increased upon the addition of a lime purifier by 3.23 standard candles, making its actual illuminating power equal to 30.71 standard wax candles. The Manhattan gas is without doubt the best gas supplied by any company in America, and much superior to most English gas. The average standard candle power of the coal gas supplied throughout the United States does not exceed 11 candles, and the illuminating power of petroleum gas can be raised to 36 candles, or reduced to 11 candles, according to the wishes of the manufacturer, by a process perfectly simple, safe and reliable.

THOMSON'S PATENT PETROLEUM GAS.

St. Nicholas Hotel, New York,
Dec. 10, 1862.

The proprietors of the St. Nicholas Hotel, New York, have recently introduced into their establishment the process for the manufacture of illuminating gas from petroleum, patented by Mr. James Edward Thomson, of Buffalo and Toronto. The results which have been attained during a trial extending over one week (from December 3rd to December 10th), are sufficient to warrant the proprietors in testifying to its excellence as an illuminator, and its comparative cheapness even at the present high prices of petroleum. These results establish the fact that even with crude petroleum at fifty cents a gallon, the cost of lighting their establishment by means of Thomson's patented petroleum gas is less than one-half the cost of Manhattan gas; and with petroleum at twenty cents a gallon, the cost will be one-fourth that of Manhattan gas at $2 50 per thousand feet. The patentee first commenced to make gas at one o'clock on Wednesday, 3rd December, and succeeded in producing enough gas to supply the house from a single bench of three retorts the same night. The ordinary average consumption of the house is thirty-six thousand feet of Manhattan gas per day in the month of October. The average number of lights used daily exceeds 2,500 (two thousand five hundred). This trial having taken place in the month of December, which demands the largest consumption of gas, makes it the more satisfactory for the proprietors of the St. Nicholas to offer the patentee and the public this testimonial in favor of the new illuminator.

(Signed) JOHN P. TREADWELL, } *Proprietors.*
VIRGIL WHITCOMB, }

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SHELF NO.

A 8. American Engineering; Embracing Stationary, Marine, River Boat, Screw Propeller, Locomotive, Pumping and Steam Fire Engines, Rolling and Sugar Mills, Tools, and Iron Bridges. Plates, folio, 1861 ...... *G. Weissenborn.*

E 89. American Engineering; Letter Press. 1 vol., 4to...... "

G 23. Warming and Ventilation of Buildings, Railway Cars, &c., illustrated by fifty-four plates, Exemplifying the Exhaustion Principle. 8vo, 1862...... *Hon. H. Ruttan.*

H 46. The Art of Double-Counting on the Lathe, whereby patterns of a complex character may be produced by means of the common Eccentric Chuck, &c., with sixty illustrations. 8vo 1857 ...... *Capt. J. Ash.*

K 34. The Book of Dates, comprising the principal events in all ages, from the earliest records to the present time. 12mo, 1862 ...... *Griffin, Bohn & Co.*

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Annual Report of Smithsonian Institute for 1861. 1 vol.	"	*Smithsonian Inst.*

BRITISH PUBLICATIONS FOR OBTOBER 1862.

	£	s.	d.	
Adams (H. G.) Our Feathered Families: the Birds of Prey, illust., fcap. 8vo	0	3	6	*Hogg.*
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——— Hunt (R.) Handbook to Indust. Depart. Vol. 2, fcap. 8vo	0	4	0	*Stanford.*
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Pick (Dr. Ed.) On Memory and the Rational Means of Improving it, 2nd ed., fp. 8vo	0	2	6	*Trübner.*
Snowden's Police Officers, Con. Guide, and Mag. As., 5th e., by W. C. Glen, 12mo	0	10	0	*Shaw & Sons.*
Townsend (George H.) Manual of Dates, a Dictionary of Reference, cr. 8vo	0	12	6	*Routledge.*
Wood (Rev. J. G.) Athletic Sports and Recreations for Boys, fcap. 8vo, adv. to	0	2	0	*Routledge.*

AMERICAN PUBLICATIONS FOR NOVEMBER.

Bovee (C. N.) Intuitions and Summaries of Thought, 2 vols. 12mo		*Wm. Vearie.*
Dana (Jas. D.) Manual of Geography; with Special Reference to American Zoological History, 1 vol. 8vo	4 00	*T. Bliss & Co.*
Haraszthy (A.) Grape Culture and Wine Making; the Official Report of the Commissioners appointed to investigate the Agriculture of Europe. Maps and Illustrations, 8vo		*Harper & Bros.*
Taylor (Bayard) the Poet's Journal, 12mo		*Ticknor & Fields.*

PRIZE LIST.

The following is the corrected List of Prizes awarded in the Arts and Manufactures Department of the Provincial Exhibition, held in the City of Toronto in September last.

PRIZE LIST.

COMPETITION OPEN TO CANADIAN EXHIBITORS ONLY.

CLASS XXXVIII.—Cabinet-Ware and other Wood Manufactures—(61 Entries.)

Judges—George Stephens, Cobourg; George Jackson, Simcoe.

Best Bed Room Furniture, set of, Jacques & Hay, Toronto, $10; 2nd do., do., do., $8.

Best Centre Table, do., do., $7.

Best Drawing Room Sofa, do, do., $7.

Best Drawing Room Chairs, set of, do., do., $7.

Best Wardrobe, do., do., $5; 2nd do., do., do., $4.

Best Cooper's Work, Corridon Lewis, Salford, $4; 2nd do., R. S. Dodd, Stratford, $3.

Best Curled Hair, 10 lbs., Peter R. Lamb, Toronto, $3; 2nd do., do., do., $2.

Best Handles for Tools for Carpenters, Blacksmiths, Gunsmiths, Watchmakers, &c., collection of, Thomas Moore, Etobicoke, $8.

Best Joiner's Work, assortment of, Smith & Burke, Toronto, $8.

Best Machine wrought Moulding and Flooring, 100 feet of each, do., do., $6.

Best Turning in Wood, collection of specimens, Jacques & Hay, Toronto, $6; 2nd do., Smith & Burke, Toronto, $4.

Best Veneers, from Canadian Woods, W. Clements, Newbury, $10; 2nd do., F. F. Purdy & Brother, Newbury, $6.

Best Wash Tubs and Wooden Pails, three of each, factory made, Corridon Lewis, Salford, $4.

Extra Prizes.

Ker & Brother, Streetsville, samples of Jack Spools and Bobbins for Woollen and Cotton Mills, $2.

P. T. Ware & Co., Toronto, three Sewing Machine Cases, $3.

William and Thomas Walker, Brampton, Washing Machine, $2.

O. W. Everett, Dundas, lot of Turned Wooden Bowls, $2.

Richmond & Walton, London, Clothes Dryer, $4.

Henry Fryatt, Aurora, Scrubbing Machine, commended.

Thomas McMurchy, Glenwilliam, Pat. Mangle, $3.

John Addison, Hamilton, Patent Spring Mattrass, Diploma.

James Meyers & Son, Toronto, Washing Machine and Wringer, $2.

Harris, Brothers, Toronto, Corn Brooms, $1.

Samuel Creighton, Toronto, Spinning Wheels, $2.

Michael Malcolm, Toronto, Chess Boards, comm'd.

Wm. Haines, Toronto, specimens of Varnishing and Polishing on Grand Piano, $4.

CLASS XXXIX.—Carriages, Sleighs, and Parts thereof—(51 Entries.)

Judges—James Kay, Galt; John King, St. Thomas.

Best Bent Shafts, half a-dozen, A. P. Bussack, Stouffville, $3; 2nd do., Abraham Efner, London, $2.

Best Buggy, double seated, C. F. Hall, Toronto, $8; 2nd do., do., do., $6.

Best Buggy, single seated, Macabe & Co., Hamilton, $7; 2nd do., C. F. Hall, Toronto, $5.

Best Carriage, two horse, pleasure, C. F. Hall, Toronto, $12; 2nd do., do., do., $8.

Best Carriage, one horse, pleasure, Macabe & Co., Hamilton, $8; 2nd do., C. F. Hall, Toronto, $6.

Best Child's Carriage, John Webster, Yorkville, $4; 2nd do., Edward Colley, St. Mary's, $3.

Best Hubs, two pairs of Carriage, Abraham Efner, London, $3.

Best Rims or Felloes, two pairs of Carriage, R. McKinlay & Co., St. Catharines, $3; 2nd do., Abrm. Efner, London, $2.

Best Spokes, one dozen, machine made, carriage, Thos. C. Saunders, St. Catharines, $3.

Best two horse Pleasure Sleigh, Hart & Son, Picton, $10.

Best Sleigh, one horse, pleasure, Saml. Luke, Newburgh, $8; 2nd do., Macabe & Co., Hamilton, $6.

Best Springs, one set of Steel Carriage, Isaac Briggs Gananoque, $4; 2nd do., Moira Spring Co., Belleville, $3; extra do., Buggy Springs, John Stephenson, Unionville, $2.

Best Wheels, one pair of Carriage (unpainted), C. F. Hall, Toronto, $4.

Extra Prizes.

W. J. Hamilton, Homer, Lincoln, Trotting Buggy, $2.

Do., do., Trotting Sulky, $1.

R. McKinley & Co., St. Catharines, Bows for Carriage tops, $1.

Do., do., Rails for Buggy Seats, $1.

Do., do., Set of Bent Sulky Felloes, $1.

Do., do., Set of Cutter Stuff, $1.

Do., do., Bent Stuff and Bendings for Cutters, $2.

John Webster, Yorkville, Express Waggon, $3.

A. P. Bussick, Stouffville, Sleigh Bends, $2.

Abraham Efner, London, Bent Cutter and Sleigh Stuff, $1.

C. F. Hall, Toronto, Boston Chaise, $2.

CLASS XL.—Chemical Manufactures and Preparations—(51 Entries.)

Judges—H. Y. Hind, Toronto; Thomas J. Cottell, Woodstock; T. McIlwraith, Hamilton; W. N. Alger, Brantford.

Best Glue, 14 lbs., Peter R. Lamb, Toronto, $3; 2nd do., do., do., $2.

Best Medicinal Herbs, Roots and Plants, native growth, Dr. T. W. Poole, Norwood, $12; 2nd do., W. Saunders, London, $8.

Best Oils, Linseed and Rape, and other expressed kinds, Robert Pomeroy, Toronto, $6.

Best Oil (Coal, Shale or Rock) Petrolia Refining Co., Petrolia, $6; 2nd do., T. W. Esmonde, Toronto, $4.

Extra Prizes.

A. C. Walkinshaw, Toronto, Blue-black Writing Fluid, Copying Ink, Black Writing Ink, Blue Writing Fluid, Red Writing Fluid and Indelible Writing Ink, all commended, $3 for the assortment.

Peter R. Lamb, Toronto, Neat's Foot Oil, $2.

Note by Judges.—The specimens of oil exhibited, both in the raw and manufactured state, are favorable samples of this new branch of industry; but as a scientific analysis of the samples produced would be of no commercial value, the Judges have awarded the prizes to the exhibiters who have shown the best assortment of Oils from Canadian Petroleum.

CLASS XLI. — DECORATIVE AND USEFUL ARTS, DRAWINGS AND DESIGNS—(91 Entries.)

Judges—John Shier, Whitby ; C. Quinlan, Port Hope ; Wm. Boys, Barrie.

Best Carving in Wood, R. E, Griffith, Toronto, $6 ; 2nd do., James McGee, Toronto, $4.
Best Decorative House Painting, And. Widdowson, Toronto, $5 ; 2nd do., Geo. D. Lucas, do., $3.
Best Engraving on Wood, with proof, Edwd. Roper, Hamilton, $5 ; 2nd do., Edwd. Hooper, Toronto, $3.
Best Goldsmith's Work, Joseph Robinson & Co., Toronto, $5 ; 2nd do., Savage & Lyman, Montreal, $3.
Best Geometrical Drawing of Engine or Millwright Work, colored, P. A. Peterson, Toronto, $5 ; 2nd do., Wm. Gill, Toronto, $3.
Best Lithographic Drawing, W. C. Chewett & Co., Toronto, $5.
Best Lithographic Drawing (colored), L. Magnus, Toronto, $6 ; 2nd do , L. Magnus, do., $4.
Best Mantel Piece, in marble, W. H. Sheppard, Toronto, $10 ; 2nd do., N. L. Steiner, Toronto, $6.
Best Mathematical, Philosophical and Surveyor's Instruments, collection of, A. F. Potter, Toronto, $15 ; 2nd do., Geo. Mathias, do., $10.
Best Modelling in Plaster, Charles Bell, Toronto, $6 ; 2nd do., Farrall & Duckworth, Toronto, $4.
Best Monumental Tomb or Headstone, Borrowman & Pearse, Toronto, $6 ; 2nd do., Robert Sheppard, do., $4.
Best Picture Frame, ornamented gilt, Mr. Scott, Montreal, $5 ; 2nd do., Mr. Scott, do., $3.
Best Seal Engraving, Thos. Wheeler, Toronto, 2nd prize, $4.
Best Silversmith's Work, J. G. Joseph & Co., Toronto, $5 ; 2nd do., Savage & Lyman, Montreal, $3.
Best Stained Glass, col'n of specimens, McCausland & Horwood, Toronto, $10 ; 2nd do., W. Bullock, Toronto, $6.

Extra Entries.

Map of Canada, Tackabury, Bros., London, $4.
Dialing Instrument, W. H. Sheppard, Toronto, $5.
Designs and Stamps for Embroidery, Wm. Williams, Toronto, $3.
Decorative Sign Painting, George Booth, Toronto, $5.
Lithographic Drawings, W. C. Chewett & Co., Toronto, $3.
Assortment of Gold and Silver Leaf, and Dentist's Gold Foil, C. W. Hubbard, Toronto, $4.
Map Engraving and Printing (Map of Upper Canada) G. C., G. R., and G. M. Tremaine, Toronto, Diploma and $6.
Writing on Glass in Gold, Geo. D. Lucas, Toronto, $3.
Dentistry, Wm. Myers, Toronto, $4.
Sign Writing or Gilding on Glass, And. Widdowson, Toronto, $4.
Specimens of Penmanship, I. Bates, Toronto, $5.
Orr's System of Writing, J. Edwards, Toronto, $5.
Case of Dentistry, Chas. J. Curtis, Toronto, $5.
Natural Weather Indicator, L. S. Ullman, Toronto, $3.
Collection of Native Marbles, W. Haughey. Ottawa, highly commended, $5.

CLASS XLII.—FINE ARTS—(67 Entries.)

Judges—W. M. Wilson, Simcoe, Norfolk : J. D. Dumble, Cobourg ; H. W. Peterson, Guelph.

Professional List—Oil.

Best Animals, grouped or single, Robert Whale, Burford, $12 and Diploma ; 2nd do., W. N. Cresswell, Harpurhey, $8.
Best Historical Painting, W. N. Cresswell, do., $12 ; 2nd do., Robert Whale, Burford, $8.
Best Landscape, Canadian subject, Robert Whale, Burford, $12 ; 2nd do., W. N. Cresswell, Harpurhey, $8.
Best Marine Painting, Canadian subject, W. N. Cresswell, Harpurhey, $12 ; 2nd do., W. Armstrong, Toronto, $8.
Best Portrait, Robert Whale, Burford, $10 ; 2nd do., not numbered ("Indian Girl"), $7.

In Water Colors.

Best Animals, grouped or single, John H. Caddy Hamilton, $8 ; 2nd do., Wm. Armstrong, Toronto, $6
Best Flowers, grouped or single, John Griffith London, $8 ; 2nd do., Miss A. F. H. Gibbon, Weston. $6.
Best Landscape, Canadian subject, John H. Caddy, Hamilton, $8 ; 2nd do., W. N. Cresswell, Harpurhey, $6.
Best Marine View, Canadian subject, W. Armstrong, Toronto, $8 ; 2nd do., W. N. Cresswell, Harpurhey, $6.

Pencil, Crayon, &c

Best Crayon, colored, Wm. Armstrong, Toronto, $6 ; 2nd do., Miss Amelia F. H. Gibbon, Weston, $4.
Best Crayon, plain, do., do., $6 ; 2nd do., Miss Annie Bushell, London, $4.
Best Pencil Drawing, J. C. Braithwaite, Toronto, $6 ; 2nd do., do , do., $4.
Best Pen and Ink Sketch, Miss Amelia F. H. Gibbon, Weston, $6 ; 2nd do., F. H. Verner, Toronto, $4.

Amateur List—Oil.

Best Animals, grouped or single, John Whale, Burford, $9 ; 2nd do., do., do., $7 ; do., highly commended, Mrs. Gourlay, Hamilton.
Best Historical Painting, Rev. Wm. Grant, Port Perry, $9 ; 2nd do., Miss M. A. Evans, Toronto, $7.
Best Landscape, Canadian subject, J. Whale, Burford, $9 ; 2nd do., A. H. Gilmore, Toronto, $7.
Best Marine Painting, Canadian subject, J. Whale, Burford, $9 ; 2nd do., do., do., $7.
Best Portrait, do., do., $8 ; 2nd do., Miss Beddome, London, $6.

In Water Colors.

Best Animals, grouped or single, F. A. Wise, Toronto, $8 ; 2nd do., Miss Kirkpatrick, Kingston, $6.
Best Flowers, grouped or single, M. L. Brunskill, Toronto, $5 ; 2nd do., James Griffiths, London, $3 ; do., highly commended, M. Thompson, Toronto.
Best Landscape, Canadian subject, T. D. Belfield, Grafton, $8 ; 2nd do., Wm. Ambrose, Hamilton, $6 ; do., highly commended, Mrs. B. Walker, St. Thomas.
Best Marine View, Canadian subject, T. D. Belfield, jun., Grafton, $8 ; 2nd do., W. Ambrose, Hamilton, $6.

Pencil, Crayon, &c.

Best Crayon, colored, E. A. Mara, Toronto, $5 ; 2nd do., Miss E. J. Thompson, Toronto, $3.
Best Crayon, plain, Miss Rowe, Whitby, $5 ; 2nd do., Mrs. Henry Reid, Toronto, $3.
Best Pencil Drawing, Miss Maughan, Windsor St., Toronto, $5 ; 2nd do., do., do., $3 ; extra do., James Griffith, London, $2 ; highly commended, George Armitage, Toronto.
Best Pen and Ink Sketch, Mrs. Gourlay, Hamilton, $5 ; 2nd do., Edward Roper, Hamilton, $3 ; do., extra prize, J. G. Horn, Toronto, $2.

Photography.

Best Collection of Ambrotypes, Jas. Rawe, Toronto, $7.

Best Collection of Photograph Portraits, in duplicate, one set colored, Carl Loeffler, do., $10 ; 2nd do., do., do., $8.

Best Collection of Photograph Portraits, plain, Mathews & Anderson, Toronto, $8; 2nd do., Jas. R. Hay, do., $6.

Best Collection of Photograph Landscapes and Views, W. Armstrong, Toronto, $9 ; 2nd do., Mathews & Anderson, do., $7.

Best Photograph Portraits in Oil, James Rawe, Toronto, $8 ; 2nd do., R. A. Pauling, Hamilton, $6.

Extra Prizes.

James R. Hay, Toronto, Photographic Visiting Cards, $4.

Miss A. F. H. Gibbon, Weston, Oil Painting, "Lake of Lucerne, Switzerland," $4.

Miss Maughan, Toronto, Water Color Drawing, "English Ruins," $2.

Do., do., do., "Autumn," $2.

Do., do., do., "Cochem on the Moselle," $2.

D. Gourlay, Toronto, Stereoscope for 100 views, $4.

J. T. Carson, Toronto, Ivorytypes, $2.

Do., do., Photographs re-touched in India Ink, Diploma.

Wm. Armstrong, Toronto, two Portraits in Water Colors, $4.

Do., do., Series of Views on Lake Superior, Diploma.

Benoni Irwin, Newmarket, Drawings in Indian Ink, Diploma.

William Ambrose, Hamilton, Composition in Water Colors, $2.

T. Fitzgerald, Toronto, Enlarged Photographs, $3.

Miss Kirkpatrick, Kingston, Ferns in India Ink, $2.

Remarks by Judges.—The judges have found great difficulty in performing their duties in a manner satisfactory to themselves from the defective arrangement of the specimens. Many have not been seen at all. They would recommend that the persons in charge of the departments should be instructed to place sections as much as possible together. The judges have much pleasure in remarking that a decided improvement is observable in the Fine Arts department.

CLASS XLIII.—Groceries and Provisions—(77 Entries.)

Judges — F. W. Fearman, Hamilton ; D. McLaren, Mitchell ; E. A. McNaughton, Newcastle.

Best Barley, Pearl, Robt. King, Hamilton, $3 ; 2nd do., A. Mitchell, York, $2.

Best Barley, Pot, Robert King, Hamilton, $3 ; 2nd do., A. Mitchell, York, $2.

Best Bottled Pickles, an assortment, manufactured for sale, C. B. Rowland & Co., Toronto, $6.

Best Cayenne Pepper, from capsicums grown in the Province, H. Girouard, Hamilton, $2.

Best Chickory, 2 lbs., G. Pears, Toronto, $3 ; 2nd do., D. Crawford & Co., Toronto, $2.

Best Indian Corn Meal, Robert King, Hamilton, $3.

Best Oatmeal, James Russell, Claremont Mills, $3.

Best Sauces, for table use, an assortment, manufactured for sale, C. B. Rowland & Co., Toronto, $6.

Best Soaps, collection of assorted fancy, C. Watts, Brantford, $6 ; 2nd do., P. Freeland & Co., Toronto, $4.

Best Starch, 12 lbs of Corn, Benson & Asphden, Edwardsburgh, $2.

Best Starch, 12 lbs. of Flour, Klotz, Brothers, Preston, $2.

Best Wheat Flour, Elias Snider, jun., Waterloo, $4. 2nd do., G. Wheeler, Uxbridge, $3 ; do., extra prize, John Kemp, Dunbarton, $2.

Extra Prizes.

Six Jars Preserves, Miss E. Charles, Yorkville, $2.

Split Pleas, James Wilson, Eden Mills, $2.

Pickling Vinegar, B. E. Charlton, Hamilton, Dip.

Two Bottles Brandy, W. H. Smith & Co., Toronto, commended.

Mustard, D. Crawford & Co., commended.

Ground Spices, do., do., $2.

Keg Challenge Soap, W. F. Langlois, Toronto, commended.

Callection of Biscuits, M. Nasmith, Toronto. $3.

Table Sauces, Mrs. Jesse Thomson, Yorkville, $2.

Preserves, 12 kinds, Mrs. Jesse Thomson, Yorkville, $2.

Rock Candy, M. Davis, Toronto, $2.

Collection of Biscuits, Christie, Toronto, Diploma.

Note by Judges.—The judges on Class 43 desire to express their regret that there has not been more care taken in classifying the different articles. A great many articles that have been entered are not to be found, and others are placed in other classes ; for example, wine, maple sugar, bacon, &c., in the dairy class ; and no order on the table where the class is placed.

CLASS XLIV.—Ladies' Work—(424 entries).

Judges — Mrs. R. L. Denison, Toronto ; Mrs. Dr. Beatty, Cobourg ; Mrs. F. W. Coate, Toronto ; Mrs. J. F. Kidner, ———.

Best Braiding, Miss E. Eckhardt, Unionville, $3 ; 2nd do., Miss F. Arnoldi, Toronto, $2.

Best Crochet Work, Miss J. A. Ramsey, Kingston, $3 ; 2nd do., Miss Bidwell, Cramahe, $2 ; 3rd do., Miss Annie Norton, Toronto, $1 ; do. commended, Miss Isabella Hunter, Orillia.

Best Embroidery in Muslin, Miss Bidwell, Cramahe, $3 ; 2nd do., Miss J. A. Ramsey, Kingston, $2.

Best Embroidery in Silk, Mrs. J. Johnston, Toronto, $3 ; 2nd do., Miss Rosa Cameron, Toronto, $2.

Best Embroidery in Worsted, Miss R. M. Evans, London, $3 ; 2nd do., Miss Beddome, London, $2.

Best Gloves, three pairs, Platt Hinman, Grafton, $2 ; 2nd do., Mrs. Harper, Aurora, $1.

Best Guipure Work, Miss Bidwell, Cramahe, $3 ; 2nd do., Mrs. I. Bates, Hamilton, $2.

Best Knitting, Mrs. Harper, Aurora, $3 ; 2nd do., Mrs. E. Agar, Burwick, $2.

Best Lace Work, Miss Maria Matthews, Belleville, $3 ; 2nd do., Miss Bidwell, Cramahe, $2 ; extra do. (equal to first Limerick lace), Miss Helen Raleigh, Toronto, $3.

Best Mittens, three pairs Woollen, Platt Hinman, Grafton, $2 ; 2nd do., Mrs. C. Miller, Norval, $1.

Best Needle Work, Ornamental, Madame Griebel, Toronto, $3 ; 2nd do., Miss J. A. Ramsey, Kingston, $2.

Best Netting, Fancy, Miss E. Strickland, Oshawa, $3 ; 2nd do., Miss M. Strickland, Oshawa, $2.

Best Plait for Bonnets or Hats, of Canadian straw, Mrs. Silverthorn, Toronto, $3 ; 2nd do., Mrs. H. Stickle, Cobourg, $2.

Best Gentleman's Shirt, Mrs. M. A. Johnston, Yorkville, $3 ; 2nd do., Mrs. J. T. Ewart, Woodbridge, $2.

Best Socks, three pairs Woollen, Mrs. D. Christie, Utica, $2 ; 2nd do., Mrs. Alex. Gerrie, Dundas, $1.

Best Stockings, three pairs Woollen, No. 10 (name not known), $2 ; 2nd do., Mrs. A. Gerrie, Dundas, $1.

Best Tatting, Miss J. A. Ramsey, Kingston, $3 ; 2nd do., Miss Hettie Denison, Toronto, $2.

Best Wax Fruit, Miss Sophia Graham, Streetsville, $6; 2nd do., Miss M. Lyman, Toronto, $4.

Best Wax Flowers, Mrs. A. Dredge, Toronto, $6; 2nd do., a case, all white (ticket misplaced), $4.

Best Worsted Work, Miss Ann Unwin, Toronto, $3; 2nd do., Miss Ann Unwin, Toronto, $2.

Best Worsted Work, Raised, Miss J. A. Ramsey, Kingston, $3; 2d do., Miss J.A. Ramsey, Kingston, $2.

Extra Prizes.

Miss Mary Sheppard, Willowdale, Hearth Rug, $2.

Mrs. Harper, Aurora, Knitted Quilt, $2.

Miss Dover, Toronto, Silk Table Cover, $1.

Miss Elizabeth McEvers, Cobourg, Ornamental Wreath in Seeds, $4.

Miss Isabella Graham, Streetsville, case of Wax Shells, $6 and Diploma.

Miss Isab. Graham, Streetsville, Work in Hair, $3.

Mrs. Fenwick, Markham, Counterpane, $2.

Mrs. D. Howland, Hamilton, case Hair Jewellery, $3.

Mrs.E.Goldsmith,Toronto, Knitted Counterpane, $2.

Mrs. G. Wiley, Richmond Hill, Hearth Rug, $1.

Mrs. Wright, Toronto, Wax Figure of Her Majesty the Queen, $2.

Mrs. S. A. Johnstone, Yorkville, Night Dresses, $1.

Mrs. Wood, Toronto, Tatting Work, $1.

Miss M. J. Wilson, Yorkville, Woollen Shawl, $1.

Miss Jane Mitchell, P. Hope, Transferred Work, $1.

Miss Rosa Parady, Toronto, Bead Work, $1.

Miss Bidwell, Cramahe, Cordon Collar and Cuffs, $2.

Mr. G. Silverthorn, Toronto, Straw Hat and Bonnet, $1.

CLASS XLV.—Machinery, Castings and Tools—(78 Entries.)

Judges—James Crossen, Cobourg; W. P. Phillips, Kingston; Robert McKechnie, Dundas.

Best Castings for General Machinery, J. Gartshore, Dundas, Wentworth, $10.

Best Castings for Railways, Railroad Cars and Locomotives, assortment of, John Gartshore, Dundas, $15.

Best Edge Tools, assortment, H. H. Date, Galt, $20.

Best Pump, in metal, C. P. Hinds, Toronto, $5; 2nd do., Isaac Briggs, Gananoque, $3.

Best Refrigerator, J. W. Esmonde, Toronto, $6.

Best Sewing Machine, Manufacturing, R. M.Wanzer & Co., Hamilton, $10; 2nd do., L. N. Soper, Woodstock, $7; Thomas Halligan, Newmarket; extra do., for a new improvement in Sewing Machines, adapting them to waxed thread, Diploma and $10; do., commended, Patterson & Irwin, Belleville.

Best Sewing Machine, Family, R. M. Wanzer & Co., Hamilton, $10; 2nd do., Patterson & Irwin, Bellville, $7.

Best Valves and Gearing for working Steam expansively, either in model or otherwise — principle of working to be the point of competition, William Gill, Toronto, $12.

Extra Prizes.

Fire Detector and Burglar Alarm, Salem Eckhardt, Unionville, Diploma and $3.

Blacksmith's Fire Iron, Salem Eckhardt, Unionville, $2.

Hand-power Loom, Miles Welsh, Brantford, $5.

Saw Shingle Machine, J. W. & N. Green, Waterford, $4.

Wood-sawing Machine, David Bruce, London, $5.

Four Amalgam Bells, Irwine & Sons, Uxbridge, $5.

Machine for making Bats, Elisha Simkins, Toronto, $2.

Coal Mining Machine, Elisha Simkins, Toronto, $2.

Shingle Machine, G. O. S. Conway, Ashburn, $5.

Patent Fire Escape, George Campbell, Toronto, $2 and Diploma.

Model of a Locomotive, F. A. Gardner, Hamilton, $5.

Engine Beer Pump, D. S. Keith, Toronto, $4.

Self-regulating Steam Warming Apparatus, D. S. Keith, Toronto, $8.

Green House Hot Water Boiler, D. S. Keith, Toronto, $3.

Portable Gas Making Apparatus, D. S. Keith, Toronta, $5.

Blacksmith's Bellows, Saml.Westman, Toronto, $3.

Smith's Forge Bellows, Jos. Dallyn & Sons, Hamilton, $5.

A pair of Mill Stones, J. Gartshore, Dundas, $10.

Bran Duster, John Gartshore, Dundas, $8.

Central Disharge Water Wheel, John Gartshore, Dundas, $5.

Forty Horse-power Steam Engine, not in operation, John Gartshore, Dundas, $20.

Model of Improved Steam Engine, for Working Steam Expansively, Thomas Northey, Hamilton, Diploma and $2.

Cracker and Biscuit Machine, W. W. Gibson, Dundas, $10.

Coffee Mill, W. W. Gibson, Dundas, $3.

Sugar Mill, do., do., $2.

Fire Engine, W. Marks, Toronto, $10.

Branch Rail for Track, J. Findlay, Toronto, $2.

Shingle Machine, Jas. Davidson, Cobourg, $10.

Double Box Loom, James Davidson, Cobourg, $10 and Diploma.

Washing Machine, James Spring, Dorchester, $2.

Machine for making Tin Eave Trough, Robert Emery, Toronto, $3.

Mill Stones, R. H. Oates, Toronto, $5.

Tailor's Shears, Geo. & S. Rogers, Toronto, $2.

Steam Guages, Joshua Lowe, Toronto, $10 and Diploma.

Model of Patent Churn, Mrs. M. Murdoch, Port Dalhousie, $1.

Combination Carriage, Mrs. M. Murdoch, Port Dalhousie, $1.

Model of Iron Waggon, Mrs. M. Murdoch, Port Dalhousie, $2.

Model of Seed Drill, Mrs. M. Murdoch, Port Dalhousie, $2.

Improved Rat Trap, J. B. Ryan, Toronto, $1.

Self-acting Cattle Guard, James Forrest, Ontario, Co. Wentworth, $2.

Small Saw Mill, Aaron Scott, Dereham, $4.

CLASS XLVI.—Metal Work (Miscellaneous) Including Stoves—(95 Entries.)

Judges—A. K. Boomer, Toronto; John Watson, Ayr; Thos. D. Harris, Toronto.

Miscellaneous.

Best Coal Oil Lamps, an assortment, Parsons Brothers, Toronto, not manufactured in Canada, diploma; 2nd do., H. Piper & Brother, Toronto, not manufactured in Canada, diploma.

Best Coppersmith's Work, an assortment, Booth & Brother, Toronto, $7.

Best Fire Arms, an assortment, W. P. Marston, Toronto, $7; 2nd do., James M. Jones, Chatham, $5.

Best Files, collection of cast steel, Andrew Hart, Hamilton, $3.

Best Fire Proof Office Safe, J. & J. Taylor, Toronto, $8; 2nd do., J. & J. Taylor, Toronto, $6.

Best Iron Fencing and Gate, ornamental, Wm. Bain, Sandwich, $7.

Best Iron Work from the Hammer, ornamental, Wm. Midford, Ottawa, $6; 2nd do., James Berry, Wellington Square, $4.

Best Locksmith's Work, an assortment, R. J. Brown, Toronto, $7; 2nd do., J. & J. Taylor, Toronto, $5.

Best Nails, 20 lbs. of pressed, Cavan & Britton, Gananoque, $6.

Best Nails, 20 lbs. of cut, Cavan & Britton, Gananoque, $6; 2nd do., Cavan & Britton, Gananoque, $4.

Best Plumber's Work, an assortment, John Ritchie, Toronto, $6; 2nd do., D. S. Keith, Toronto, $4.

Best Tinsmith's Lacquered Work, an assorment of, Booth & Brother, Toronto, $6.

Best Wire Work, an assortment of, W. H. Coo, Toronto, $6.

Stoves.

Best Cooking Stove, for wood, with furniture, John McGee, Toronto, $6; 2nd do., J. McGee, Toronto, $4.

Best Cooking Stove, for coal, with furniture, J. G. Beard & Sons, Toronto, $6; 2nd do, J. G. Beard & Sons, Toronto, $4.

Best Hall Stove, for wood, John McGee, Toronto, $5; 2nd do., John McGee, Toronto, $3.

Best Hall Stove, for coal, John McGee, Toronto, $5; 2nd do., John McGee, Toronto, $3.

Best Parlour Stove, for wood, John McGee, Toronto, $5; 2nd do., J. G. Beard & Sons, Toronto, $3.

Best Parlour Stove, for coal, J. McGee, Toronto, $5.

Extras.

Improved Fire-place, W. H. Sheppard, Toronto, diploma.

Three Iron Bedsteads, J. A. Taylor, Toronto, $5.

Parlour House Safe, J. A. Taylor, Toronto, $3.

Plumber's Brass Work, John Ritchie, Toronto, diploma.

Engineer's Brass Work, John Ritchie, Toronto, $5.

Soda Water Fountain, T. Smith, Toronto, diploma.

Soda Water Bottling Machine, T. Smith, Toronto, diploma.

Specimens of Iron Rivets, Isaac Briggs, Gananoque, diploma.

A Collection of Saws, Morland, Watson & Co., Montreal, diploma.

Pair of Self-fastening Skates, R. J. Brown, Toronto, diploma.

Zinc Window Sash and Eave Troughs of Zinc and Galvanized Iron, Edward Colley, St. Mary's, diploma.

Steam and Water Engineering Brass Work, D. S. Keith, Toronto, diploma.

Assortment of Stamped Copper Bottoms, J. McGee, Toronto, diploma.

Sample Smoothing Irons, Ives & Allan, Montreal, diploma.

Patent Door Bell, A. E. Taylor, Brockville, diploma.

Railway Switches, J. Kitchen, Kingston, diploma.

Laundry Stove, J. G. Beard, Toronto, diploma.

New and Useful Apparatus for Economizing Fuel in Heating Rooms, applicable to open grates, E. Vernon, Hamilton, $5 and diploma.

Assortment of Weights and Measures, H. Piper & Brother, Toronto, $5.

CLASS XLVII. — MISCELLANEOUS, INCLUDING POTTERY AND INDIAN WORK—(56 Entries).

Judges—D. B. Garton, Barrie; David Savage, Belleville.

Miscellaneous.

Best Brushes, an assortment, Charles Boeckh, Toronto, $6; 2nd do., Alfred Green, Hamilton, $4.

Best Model of a Steam Vessel, Richard Osborne, Newburg, $6.

Best Model of a Sailing Vessel, Richard Osborne, Newburg, $6; 2nd do., Richard Osborne, Newburg, $4.

Pottery.

Best Filter for Water, Jos. Brown, Carlton West, $3; 2nd do., F. P. Gould, Brantford, $2.

Best Pottery, an assortment, Jos. Brown, Carlton West, $8; 2nd do., Wm. Lea, York, $5.

Best Sewerage Pipes, Stoneware, assortment of sizes, W. & R. Campbell, Hamilton, $10; 2nd do., F. P. Gould, Brantford, $6.

Best Assortment of Stoneware, F. P. Gould, Brantford, $10.

Best Slates for Roofing, Benj. Walton, Toronto, $8.

Extra Prizes.

Artificial Limbs, John Condell, Brockville, $4.

Stove-pipe Conductor of Artificial Stone, W. H. Sheppard, Toronto, $2.

Patent Canvas Felt, W. D. Darlington, Toronto, $3.

Artificial Limbs, Norris Black, Toronto, $3.

Lamp Chimney Cleaners, C. Boeckh, Toronto, $1.

Earthenware Vases, John Burns, Yorkville, $1.

Specimens of Indian Work, "sox ska tien a chi," of Coughnawaga, $3.

CLASS XLVIII.—MUSICAL INSTRUMENTS—(31 Entries.)

Judges—G. W. Strathey, Mus. Doc., Toronto; Prof. F. W. Sofge, Toronto.

Best Harmonium, R. S. Williams, Toronto, $10; 2nd do., Andrews Bros., London, $6.

Best Melodeon, R. S. Williams, Toronto, $6; 2nd do., Andrews Bros., London, $4.

Best Organ, Church, Edward Lye, Toronto, $25.

Best Piano, Square, John C. Fox, Kingston, $15; 2nd do., W. G. Vogt & Co., Montreal, $10.

Best Piano, Grand, J. Thomas & Co., Toronto (2nd prize), $10.

Best Piano (Cottage), J. Thomas & Co., Toronto (2nd Prize), $6.

Best Violin, Silas Coleman, Toronto, $3; 2nd do., Coridon Lewis, Salford, $2.

Extra Prizes.

Violin Case, Silas Coleman, Toronto, $2.

Double Bass, Silas Coleman, Toronto, $3.

Bass Drum, R. S. Williams, Toronto, $1.

Side Drum, in wood, R. S. Williams, Toronto, $1.

Side Drum, in brass, R. S. Williams, Toronto, $1.

Finishing of Piano Action, C. Baker, Toronto, $2.

CLASS XLIX.—NATURAL HISTORY—(17 Entries.)

Judges—H. Y. Hind, Toronto; Thomas McIlwraith, Hamilton; T. J. Cottell, Woodstock; W. N. Alger, Brantford.

Best collection of Stuffed Birds of Canada, classified, and common and technical names attached, S. Passmore, Toronto, $8.

Best collection of Native Fishes, stuffed or preserved in spirits, and common and technical names attached, Samuel Passmore, Toronto, $8.

Best collection of Native Insects, classified, and common and technical names attached, Wm. Saunders, London, $8.

Best collection of Minerals of Canada, named and classified, Thomas Herrick, Toronto, $8; 2nd do., W. W. Fox, Toronto, $6.

Best collection of Native Plants, arranged in their natural families, and named, T. Poole, M.D., Norwood, $8; 2nd do., Miss Kate Crooks, Hamilton, $6.

Best collection of Stuffed Birds and Animals of any country, Samuel Passmore, Toronto, $8.

Extras.

Basket of Sea Weed, Mrs. Mary Gall, Toronto, commended.

Book of Fern Leaves, Mrs. Dredge, Toronto, commended.

Sea Weed, Mrs. Dredge, Toronto, commended as very tastefully arranged.

Collection of Sea Weed, Miss C. Carmichael, Toronto, commended.

CLASS L.—Paper, Printing, Bookbinding & Type. (26 Entries.)

Judges—John Edwards, Toronto; David Wyllie, Brockville; Archibald McLachlin, Mitchell.

Best Bookbinding, Blank Book, assortment of, Brown Brothers, Toronto, $5; 2nd do., W. C. Chewett & Co., Toronto, $3.

Best Bookbinding, Letter-press, assortment of, Brown Brothers, Toronto, diploma and $5.

Best Letter-press Printing, Plain, W. C. Chewett & Co., Toronto, $5; 2nd do., Geo. Brown, Toronto, $3.

Best Letter-press Printing, Ornamental, G. Brown, Toronto, diploma and $5.

Best Paper Hangings (Canadian paper), one dozen rolls, assorted, Barber & Bros., Georgetown, diploma and $7.

Best Printing, Wrapping and Writing Papers, one ream of each, Buntin Bros., Toronto, $7; 2nd do., Barber Bros., Georgetown, $5.

Best Printing Type, an assortment, C. T. Palsgrave, Toronto, $7.

Extras.

Paper Cloth Address Labels, T. Hill, Torodto, $2.

Machine for Cutting and Mitering Printers' Rules, John Fenton, Toronto, diploma.

Blotting Paper, Colored Paper and Envelopes, Buntin Bros., Toronto, diploma.

Assortment Letter-press Printing, W. C. Chewett & Co., Toronto, $2.

Bankers' Cases, &c., Brown Bros., Toronto, $2.

Pocket Books, Wallets, &c., Brown Bros., Toronto, diploma.

Embossed Cloth Cases, Brown Bros., Toronto, $1.

Ornamental Cards, G. Brown, Toronto, commended.

Plain Cards, Geo. Brown, Toronto, commended.

Plain Posters, Geo. Brown, Toronto, commended.

Ornamental Posters, Geo. Brown, Toronto, diploma.

Letter-press Printing, varieties, G. Brown, Toronto, commended.

CLASS LI.—Saddle, Harness, Engine Hose, and Trunk Makers' Work, and Leather. (79 Entries.)

Judges—Duncan McKay, Brantford; Thomas Field, Galt; H. Thompson, Waterdown.

Best Engine Hose and Joints, 2¾ inches in diameter, 50 feet of copper rivetted, T. Thompson, Toronto, $6.

Best Harness, set Double Carriage, Marshall Porter, Bowmanville, $8; 2d do., J. & R. Irvine, Montreal, $6.

Best Harness, set of Single Carriage, A. Fraser, Hamilton, $6; 2nd do., W. Steward, jun., Toronto, $4.

Best Harness, set of Team, R. Malcolm, Toronto, $5; 2nd do., W. Steward, jun., Toronto, $3.

Best Saddle, Lady's Full Quilted, W. Steward, jun., Toronto, $8; 2nd do., Thos. Thompson, Toronto, $6.

Best Saddle, Lady's Quilted Safe, R. M. Hinder, Toronto, $6; 2nd do., W. Steward, jun., Toronto, $4.

Best Saddle, Gentleman's Full Quilted, T. Thompson, Toronto, $7; 2nd do., J. & R. Irvine, Montreal, $5.

Best Saddle, Gentleman's Plain Shaftoe, W. Steward, jun., Toronto, $5; 2nd do., A. Fraser, Hamilton, $3.

Best Trunks, an assortment, H. E. Clarke, Toronto, $8; 2nd do., W. Steward, jun., Toronto, $6.

Best Valises and Travelling Bags, an assortment, H. E. Clarke, Toronto, $5.

Best Hames, three pairs of iron cased, team or cart, Robert Malcolm, $3.

Best Hames, six pairs of wooden team, R. C. Gill, Colborne, $3; 2nd do, Robert Malcolm, Toronto, $2.

Leather.

Best Belt Leather, 30 lbs., R. K. Johnson, Fergus, $3; 2nd do., W. M. Macklem, Chippewa, $2.

Best Brown Strap and Bridle, one side of each, W. M. Macklem, Chippewa, $3; 2nd do., R. K. Johnson, Fergus, $2.

Best Carriage Cover, two skins, Robinson & Flummerfelt, Markham, $3; 2nd do., R. K. Johnson, Fergus, $2.

Best Deerskins, dressed, Hy. Ferdinand, Waterloo, $2; 2nd do., Greene, DeWitt & Co., Montreal, $1.

Best Harness Leather, two sides, Jos. Flack, Sandhill, $3; 2nd do., Robert Dale, Sandhill, $2.

Best Hogskins for Saddles, (no first); 2nd do., R. K. Johnson, Fergus, $3.

Best Patent Leather, for carriage or harness work, (no first); 2nd do., R. K. Johnson, Fergus, $4.

Best Skirting for Saddles, two sides, W. M. Macklem, Chippewa, $4.

Extra Entries.

Stud Bridle and Roller, Marshal Porter, Bowmanville, $2.

Winker Leather, R. K. Johnson, Fergus, $2.

Buff Grain Leather, R. K. Johnson, Fergus, $2.

Express Harness, Robt. Malcolm, Toronto, $2.

Sample of Belting, U. A. Harvey, St. Davids, $2.

Assortment of Horse Collars, Robert Nicholl, Toronto, $4.

Cart Harness, Robt. Malcolm, Toronto, $2.

Pair Scotch Collars, Robert Malcolm, Toronto, $2.

CLASS LII.—Shoe and Boot-makers' Work— (78 Entries.)

Judges—John Sterling, Toronto; James Gow, Guelph James F. Wright, Vienna.

Best Boots, ladies, an assortment, John Sims, Toronto, $7; 2nd do., R. Nisbet & Co., Hamilton, $5.

Best Boots, gentlemen's sewed, an assortment, John Sims, Toronto, $7; 2nd do., R. Nisbet & Co., Hamilton, $5.

Best Boots, pegged, an assortment, John Sims, Toronto, $5; 2nd do., Childs & Hamilton, Toronto, $3.

Best Boot and Shoemakers' Lasts and Trees, an assortment, W. A. Young, Dundas, $8.

Best Calf Skins, W. M. Macklem, Chippewa, $3; 2nd do., Robinson & Flummerfelt, Markham, $2.

Best Calf Skins, two morocco, W. M. Macklem, Chippewa, $3; 2nd do., R. K. Johnson, Fergus, $2.

Best Cordovan, two skins of, R. K. Johnson, Fergus, $3; 2nd do., Wm. Jacques, Colborne, $2.

Best Dog Skins, two dressed, W. Jacques, Colborne, $3; 2nd do., A. McGlashan, York Mills, $2.

Best Kip Skins, two sides, W. M. Macklem, Chippewa, $3; 2nd do., John Tye, Whitby, $2.

Best Patent Leather, for bootmakers, 20 feet, R. K. Johnson, Fergus, $6.

Best Sole Leather, two sides, Robt. Garner, Drummondville, $3; 2nd do., Andrew McGlashan, York Mills, $2.

Best Upper Leather, two sides, W. M. Macklem, Chippewa, $3; 2nd do., Robinson & Flummerfelt, Markham, $2.

Extra Prizes.

Black Grain Kip, R. K. Johnson, Fergus, $2.
Grained Up. Leather, W. M. Macklem, Chippawa, $2.
Assortment of Shoemakers' Pegs, W. A. Young, Dundas, $2.
Boot Treeing Machine, W. A. Young, Dundas, $5.
Crimping Machine, W. A. Young, Dundas, $5.
Boston Boot Polishing Machine, W. A. Young, Dundas, $2.
Gr'd Dressed Calf Skin, Cook & Co., Yorkville, $2.
Leather Leggins, Gillyatt & Cobley, Toronto, $5.
Calf Kid, Greene, DeWitt & Co., Montreal, $4.
Sheep Kid, for gloves, Greene, DeWitt & Co., Montreal, $2.
Grained Calf Skin, John Tye, Whitby, $2.
Grained Kip Skin, John Tye, Whitby, $2.

CLASS LIII.—Woollen, Flax and Cotton Goods; and Furs and Wearing Apparel—(155 Entries.)

Judges—James F. Kidner, Hamilton; Thomas Oliver, Woodstock; Joseph Manning, Brownsville.

Best Bags, from flax or hemp, the growth of Canada, one dozen, David Smellie, Concord, $5.

Best Bags, one doz. cotton, Jos. Wright, Dundas, $4.

Best Blankets, woollen, one pair, John Woodhall, Delaware, $6; 2nd do., Ezl. Snider, Brockville, $4; Mrs. Geo. Bateman, Oakwood, commended.

Best Carpet, woollen, one piece, E. Snider, Brockville, $8; 2nd do., Reuben Lundy, Newmarket, $6.

Best Carpet, woollen stair, one piece, E. Snider, Brockville, $6; 2nd do., E. Snider, Brockville, $4.

Best Cloth, fulled, one piece, Fraser & Co., Cobourg, $6; 2nd do., J. N. Pitts, Port Dover, $4.

Best Cloth, broad, one piece, Fraser & Co., Cobourg, $6; 2nd do., Platt Hinman, Grafton, $4.

Best Counterpanes, two, John Bowman, Almira, $5; 2nd do., Hugh McMillan, Erin, $3.

Best Cordage and Twines, from Canadian flax or Hemp, assortment of, A. & D. McGregor, Toronto, $10; 2nd do., A. Main & Co., Hamilton, $6.

Best Check, for horse collars, one piece, Ezekiel Snider, Brockville, $4.

Best Drawers, factory made, woollen, one pair, J. G. Crane, Ancaster, $4.

Best Flannel, factory made, Barber, Bros., Streetsville, $5; 2nd do., Clark & Nixon, Clarksburg, $3.

Best Flannel, not factory made, one piece, Ezekiel Snider, Brockville, $5; 2nd do., W. Forfar, Ellesmere, $3.

Best Flannel, scarlet, one piece, Barber, Brothers, Streetsville, ½5; 2nd do., Barber, Brothers, Streetsville, $3.

Best Fur Cap & Gloves, H. Ferdinand, Waterloo, $4.

Best Fur Sleigh Robe, H. Ferdinand, Waterloo, $5; 2nd do., Platt Hinman, Grafton, $3.

Best Gloves and Mitts of any leather, an assortment, Greene, DeWitt & Co., Montreal, $4; 2nd do., H. Ferdinand, Waterloo, $3.

Best Horse Blankets, two pairs, Newbury Button, Milnesville, $5.

Best Kersey for Horse Clothing, one piece, H. J. Scott, Belleville, $5; 2nd do., Ez. Snider, Brockville, $3.

Best Linen Goods, one piece, David Smellie, Concord, $5.

Best Winsey, Checked, one piece, Elizabeth Patton, Milliken, $3.

Best Satinet, Black, one piece (no first); 2nd do., Disher & Haight, St. Catharines, $4.

Best Saiinet, Mixed, one piece, Disher & Haight, St. Catharines, $5; 2nd do, Barber Bros., Streetsville, $3.

Best Shirts, factory made, three woollen, Jasper G. Crane, Ancaster, $5.

Best Silk and Felt Hats, Higby, Woodruff & Co., Hamilton, $5.

Best Stockings and Socks, factory made, woollen, three pairs each, Jasper G. Crane, Ancaster, $4.

Best Suit of Clothes of Canadian Cloth, Lawson & Co., Toronto and Hamilton, $10.

Best Tweed, winter, one piece, J. N. Pitts, Port Dover, $6; 2nd do., Fraser & Co., Cobourg, $4.

Best Tweed, summer, one piece, Barber Brothers, Streetsville, $6; 2nd do., J. N. Pitts, Port Dover, $4.

Best Twines, Linen and Cotton, an assortment, Alex. Main & Co., Hamilton, $3; 2nd do., A. & D. McGregor, Toronto, $2.

Best Woollen Cloths, Tweeds, &c., an assortment, J. N. Pitts, Port Dover, $10; 2nd do., B. & W. Rosamond, Lanark, $6.

Best Woollen Shawls, Stockings, Drawers, Shirts and Mits, an assortment, J. G. Crane, Ancaster, $10.

Best Yarn, white and died, one pound of each, J. G. Crane, Ancaster, $2.

Best Yarn, fleecy woollen, for knitting, one pound, J. G. Crane, Ancaster, $2.

Best Yarn, cotton, Joseph Wright, Dundas, $2.

Extra Entries.

Black Cassimere from Merino Wool, Barber Bros., Streetsville, $4.
Oxford Gray, Barber Brothers, Streetsville, $4.
Children's Stockings, J. G. Crane, Ancaster, $1.
Overcoat of English Material, Lawson & Co., Toronto and Hamilton, $1.
Overcoat of Canadian Cloth, Lawson & Co., Toronto and Hamilton, $1.
Sheepskin Mats, John Cooke, Toronto, $1.
Oxford Doeskin, Barber Brothers, Streetsville. $3.

Notes by Judges.—The colours of the factory-made flannels need improving. Some of the home-made flannels to which we have not awarded prizes are very good, but the patterns are objectionable. The patterns of some of the woollen cloths and tweeds are also bad. An assortment of gentlemen's woollen scarfs from the Ontario Mills, Cobourg, are very good. A bale of factory cotton, manufactured by Gordon & McKay, is highly deserving of commendation.

CLASS LIV.—Foreign Manufactures—(39 Ent.)

Judges—Dr. Beatty, Cobourg; Dr. Craigie, Hamilton.

Assortment of Fishing Hooks, Fishing Tackle, Needles, &c. &c., Allcock, C. Laight & Co., Redditch, England, diploma.

Steam Fire Engine, Silsby, Myndesse & Co., Seneca, N. Y., diploma.

Patent Saponifier, and Soap manufactured therefrom, Erastus Burnham, Toronto, diploma.

Assortment of Steinway & Son's, Stodart's, and Chickering's Pianos, exhibited by A. & S. Nordheimer, Toronto; commended as first-class instruments of the respective manufacturers.

Amateur Musical Bands—(2 Bands in competition.)

Judges—G. M. Strathey, Mus. Doc., Toronto; Prof. F. M. Sofge, Toronto; W. L. Lawrason, London.

Best Canadian Amateur Band, consisting of not less than eight performers, of whom there shall not be more than two professional artists, Cobourg Brass Band, $60; 2nd do., Union Brass Bank, Toronto, $40.

Note.—The Judges would suggest an Overture being made one of the pieces to be played in future competitions.

The *Oil City Register*, referred to in an article on page 285, as being published in Titusville, Pennsylvania, is published in Oil City, at the mouth of Oil Creek, some 17 miles distant from Titusville in the centre of the Venango oil region.

Our exchanges will please notice that this Journal, commencing with the next number, will be published at the uniform subscription of 50 cents per annum; and that parties sending $5 for ten subscribers, will receive a copy free.

Correspondence.

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—Believing it may be interesting to many managers of Mechanics' Institutes, among whom I understand your *Journal* largely circulates, to be informed of some of the details of the working of the library of the Institute in the city of Toronto, I beg the favor of space in your columns for that purpose.

The library referred to contains nearly 6,000 vols. of books, and is kept open for circulation and exchange each day, from 9 a.m. to 10 p.m.

The books in the library have, until lately, been arranged on the shelves according to their sizes, and not according to their subjects.

This system has been adopted so as best to economize space, and give an appearance of uniformity to the whole. The works were thus divided into about 20 sections, folios being marked A, quartos B, and so on down to the 24 mos, marked U; the vols. in each of these sections being numbered consecutively from 1 to whatever No. the section contained. In the catalogue, however, the works were all classified according to subjects, a shelf letter and No. being given before the title of each work, as in the following example:—

L 184	Sigourney's (Mrs.) Poems.
N 141	Smith's (Alex.) Poems.
Q 2	Songs, by the Ettrick Shepherd.
Q 33	Sophocles, by Francklin.
N 242	Spenser's Faerie Queene.
O 165	Surrey's (Lord) Poems.

During the present year the publication of a new catalogue had become necessary, and the directors deemed it advisable to attempt a classification of the works according to subjects on the shelves of the library, as well as in the catalogue, still retaining as far as possible the arrangement according to size. This having been accomplished, a new catalogue of some 90 pages has been issued. The whole of the works are now arranged on the shelves, and in the catalogue, on the following plan of classification:—

Section I.—Biography.
" II.—History (Civil.)
" " " (Natural.)
" " " (Religious.)
" III.—Novels and Tales.
" IV.—Poetry and the Drama.
" V.—Periodical Literature, Reviews, Magazines, &c.
" VI.—Science, Art, &c.,—
Agriculture, Botany and Gardening.
Architecture and the Fine Arts—Decorative Art—Music.
Geology, Mineralogy, &c.
Legal and Political Science, Political Economy.
Manufactures, Trades, Commerce—Mercantile Arts.
Medical Science, Physiology, Phrenology, &c.
Moral and Intellectual Philosophy, Education, &c.
Natural Philosophy, Astronomy, Mathematics, &c.
Science and Art, General.
Section VII.—Voyages and Travels.
" VIII.—Miscellaneous.
" IX.—Religious Literature.
" X.—Library of Reference.
" XI.—Valuable Illustrated Works, &c.

Eight of these sections are each divided, upon the shelves of the Library, into three sizes of books, each division having an initial letter, as, for example, section I.—A B C, section II.—D E F, and so on to the end of the alphabet—section IX. having but two divisions, and sections X. and XI. being designated by double initial letters.

The advantages attending this system of using initial letters to designate the several divisions of the books, must be apparent to all having charge of libraries, from the facilities it affords for the consecutive numbering of the works on the shelves, or the recording and tracing of those taken out. The latter will be more apparent on consideration of the plan of the record book used for the purpose in our Institute, diagrams of which I here give, hoping your printer will be able to make them up with *printer's rules.*

The record book is divided into two sections, the first having one or more pages for each of the initial letters and progressive nos. in the respective divisions; the second containing an alphabetical list of members taking out books—each member also having a number attached to his name. This portion is also ruled in spaces for recording books taken out during any stated week. The mode of recording books taken out, and crediting those returned, will be best understood by the diagrams:—

(SECTION 1ST.)

A.

	1	2	3	4	5	6	7	8	9	10	
	3				1		6				

B.

	1	2	3	4	5	6	7	8	9	10	
		4		5		2					

(SECTION 2ND.)

Week commencing Monday.

	1862.	July.				August.				
No.	Name.	7	14	21	28	4	11	18	25	
1	Abram, J...	A. 5.								
2	Allen, T....	B. 6.								
3	Brown, S...	A. 1.								
4	Benson, W.		B. 2.							
5	Curtis, R...	B. 4.								
6	Cook, N. ...		A. 7.							

It will thus be seen that J. Abram takes out A 5, which is charged to him in the proper column, the Librarian then turns to the 1st section of the record book and enters under A 5 the number of J. Abram, which is No. 1. A second party enquires for the vol. marked A 5, and the librarian turns to that letter and No. in the 1st section, and finds it charged to No. 1—referriog to No. 1 in the second section he finds the name of the party who has the work out. A third party enquires for B 5 —the librarian turns to that letter and No. in the first section of the record book, and discovers that it is not charged to any one, consequently it should be found on the shelves. The party having out B 6, brings it in ; the librarian, whether he knows the name of the party or not, turns to B 6 in the 1st section of the record, and finds it charged to No. 2, which No. he crosses with his pencil, and then turning to No. 2 in the 2nd section of the record, he crosses with his pencil the entry B 6, which stands charged against T. Allen. By this means a perfect record can be kept, and every book readily traced, by a reference to this one book.

Each record book is prepared to last for six months. Each folio in the first section should be ruled perpendicularly for fifty spaces; and the second section for 26 weeks, with horizontal lines for either 25 or 50 members' names. Each section should be indexed, both with initial letters and progressive numbers, so as to facilitate references.

I am satisfied that the plan I have here imperfectly described is admirably adapted for libraries with an extensive, or even moderate circulation. The system originated, I believe, with the late secretary and librarian of this Institute, and is not, that I am aware of, in use in any other library ; I therefore submit it for the consideration of all who may be interested in it. I would merely add, that between 600 and 700 members are regularly taking out books from our library, and that no inconvenience is experienced in making the necessary entries.

Respectfully yours,

Toronto, Nov. 28, 1862. M. T. M. I.

ON THE IMPORTANCE OF AGRICULTURAL STATISTICS.

To the Editor of the Journal of the Board of Arts and Manufactures.

SIR,—In perusing the articles on "The use to be made of our Mineral Resources," "The Agricultural Census of 1861," "On the Cultivation of Wheat in Canada," and on "The Season of 1862," contained in the August and September numbers of your valuable and talented Journal, the importance of a correct statistical report of the agriculture and trade of the Province, was strongly impressed on my mind, by seeing some errors into which the writer had been led, by following the notion of the public, and of too many of our public men, in taking the Tables of Trade and Navigation, issued by the Customs Department, as data for the quantity and value of the surplus agricultural produce annually exported from the Province.

These tables truly represent the extent of the carrying trade, and the quantity and value of goods entered at the custom houses, both for import and export; but are not so arranged as to show the quantity and value of goods exported being the growth or produce of the country. Such facts are to be found dispersed through the different tables of the report, and it would be advantageous if the Customs Department collected and arranged them in convenient form, so that the public might have an annual exhibit of the import trade for consumption, as well as of the export trade, being the surplus growth, produce or manufacture of the Province, as well as the present tables of the carrying trade.

The subjoined tables, arranged from the official report for 1861, will show what may be done even from the present returns, and the peculiar facts therein disclosed will be both useful and interesting; sufficiently so, I trust, to warrant some of

our Boards of Agriculture or Trade in an endeavor to obtain a more full and complete set from official sources, and extended, at least, from the period of the union of the Provinces to the present time. The tables are numbered 1, 2, 3 and 4.

At page 260 of the Journal, the value of the exports from the farm are represented as $14,259,225 in 1860, and $18,244,631 in 1861." These figures in the official tables represent the value of agricultural produce, viz., grain and seeds exported in these years; but, to show the net surplus, must be lessened nearly one-half by imports of the same articles—the net surplus for 1861 being $11,284,944.

In commenting on the exports of butter, beef, pork and cheese, on the same page, you have been misled by trusting to the tables.* The Province has exported butter for years, the annual value of which has lately increased very fast. Of salt beef and pork the import has always been large until 1861, when an export of $23,431 appears to contrast with an import of $1,219,437 in 1856. Table No. 2 shows this export of meats of all kinds as exceeded by that of poultry, and that is not one-fourth the value of the eggs exported in the same year. The import of cheese has always been large, and rather increased than otherwise. The fact that the import of hides and horns exceeds the value of the exports of cattle, sheep and pigs by $36,065 is curious, but rather in favor of the industry of the Province than otherwise.

The observations on the Cultivation of Wheat in Canada (p.257), and the comparisons made, further show the necessity of a more extensive statistical return, to confer on them the value to the enquirer into the true state of the agriculture of the Province which they might possess. The census for both Provinces was taken in 1851 and in 1860; both were years of most bountiful crops in Upper Canada; the returns must therefore be looked upon as accidental, and form no criterion of the produce of the wheat crops for each of the intermediate years. The deductions to be drawn from the return of the census must be checked by that of the annual export of each year within the series, and as I had previously arranged such a table from the official reports, I subjoin a copy, No. 4. From this, the risks attending this crop, and the uncertainty of the product will be evident; and the small increase of surplus between the years 1853 and 1861 must be far from satisfactory to either the agricultural or commercial men of the Province. The great falling off in the exports of 1857, 1858 and 1859, from whatever cause it had arisen, evidently led to the extensive substitution of spring for fall wheat, as the general crop throughout the country. In contrasting my table No. 4 with the table of wheat exports from Lower Canada at page 257 of the Journal, the peculiar fact is disclosed that the wheat exported from Lower Canada in 1852 exceeded the quantity exported from both Provinces in 1859.

J.

* NOTE.—Our correspondent cannot have perused the "comments" to which he refers, with attention, otherwise he would find that the increase in the production and exportation of butter is shown in the tables.—(ED.)

No. 1.

Abstract Statement of the Trade of the Province for 1861.

IMPORTS.

	$	$
Imports for Consumption:		
Goods paying duties	25.086,735	
" free	3,980,389	
		29,067,124
Imports for Exportation, or to set free an equivalent of Canadian products:		
Products of Fisheries.......	472,210	
" Forest...........	23,473	
Animals and their Products	2,354,804	
Agricultural Products......	6,953,532	
Casual Imports:		9,804,019
Coin and Bullion	3,304,675	
Military Stores.....	879,018	
		4,189,693
Imports by the St. Lawrence in transitu for the United States	522,514	
		522,514
Total Import Trade............	....	43,577,350

EXPORTS.

	$	$
The Produce or Manufacture of the Province:		
Produce of the Mine........	454,963	
Mineral Oil....................	8,155	
Produce of the Fisheries...	191,499	
" " Forest	9,549,172	
Animals and their Products	1,326,664	
Agricultural Products......	11,282,944	
Manufactures.................	289,130	
Other Articles	154,718	
Val. of Ships b'lt at Quebec	1,411,489	
Estimated am't of Exports returned short at Inland Ports.........................	1,896,947	
Re-Exports:		26,565,663
Produce of the Fisheries...	472,210	
" " Forest	23,473	
Animals and their Products	2,354,804	
Agricultural Products......	6,953,532	
Casual Exports:		9,804,019
Coin and Bullion	244,513	
		244,513
Exports by the St. Lawrence from the United States, in transitu to the sea-board...	3,505,511	
		3,505,511
Total Export Trade...........	....	40,119,706

No. 2.

Statement of Canadian Trade in Animals and their Products, for 1861.

ARTICLES.	IMPORTS. Value.	EXPORTS. Value.	EXCESS IMPORTS. Value.	EXCESS EXPORTS. Value.
Horses	$129,174	$667,355	....	$538,181
Horned Cattle	136,535	384,599	....	248,064
Sheep	18,697	149,220	....	130,523
Pigs	54,290	161,279	....	106,989
Other Animals	440	....	$440	....
Poultry and Fancy Birds	2,622	34,581	....	31,959
Butter	69,650	841,646	....	771,996
Bristles	18,379	....	18,379	....
Cheese	185,930	23,937	161,993	....
Eggs	1,176	93,341	....	92,165
Furs and Skins, Pelts and Tails, undressed	126,770	315,602	....	188,832
Grease and Scraps	11,681	....	11,681	....
Hides and Horns	545,578	23,937	521,641	....
Hair	3,882	....	3,882	....
Honey	....	4	....	....
Lard	14,928	9,759	5,169	....
Meats of all kinds	507,472	530,903	....	23,431
Tallow	242,474	583	241,891	....
Wool	295,126	434,199	....	139,073
Beeswax	....	1,089	....	1,089
Bear's Grease	....	136	....	136
Bones	....	7,738	....	7,738
Feathers	....	541	....	541
Tongues	....	62	....	62
Venison	....	957	....	957
Total Animals and their products	2,354,804	3,681,468	965,076	2,281,736

No. 3.

Statement of Canadian Trade in Agricultural Products, in 1861.

ARTICLES.	IMPORTS. Value.	EXPORTS. Value.	EXCESS IMPORTS. Value.	EXCESS EXPORTS. Value.
Broom Corn	$50,887	....	$50,887	....
Flax, Hemp and Tow	91,793	$6,452	85,341	....
Flour	711,935	6,614,665	....	$5,902,730
Barley and Rye	53,346	1,089,288	....	1,035,942
Bran and Shorts	1,338	23,690	....	22,352
Buckwheat	44	....	44	....
Oats	3,814	643,023	....	639,209
Beans and Peas	2,254	1,503,246	....	1,500,992
Indian Corn	1,087,277	310,637	776,640	....
Wheat	4,260,340	7,634,809	....	3,374,469
Meal of all kinds	17,511	255,830	....	238,319
Rice	105,022	....	105,022	....
Vegetable	28,979	23,877	5,102	....
Balsam	....	2,825	....	2,825
Pot and Pearl Barley	....	3,646	....	3,646
Green Fruit	245,259	12,258	233,001	....
Hay	....	1,443	....	1,443
Hops	....	6,026	....	6,026
Maple Sugar	....	369	....	369
Seeds of various kinds	129,962	102,770	27,192	....
Tobacco (unmanufact.)	163,771	1,622	162,149	....
Total Agricult. Products	6,953,532	18,236,476	1,445,378	12,728,322

No. 4.

Statement of the net Exports of Wheat, Flour and Bran from the Province.

YEARS.	VALUE.	RATE PER BUSHEL.	QUANTITY.
	$	$ c.	Bush.
1853	7,322,324	1 15	6,267,628
1854	6,742,200	1 31	5,146,795
1855	11,750,020	1 85	6,351,362
1856	10,476,327	1 39	7,536,925
1857	3,690,428	1 06	3,841,536
1858	2,763,509	0 97	2,848,977
1859	1,097,742	1 06	1,035,606
1860	6,367,061	1 13	5,637,222
1861	9,299,351	1 08	8,613,195

Selected Articles.

Copper Mining in Canada

A correspondent of the *London Mining Journal,* signing himself "A Cornish Agent in Canada," writes to that paper a very flattering and encouraging account of the Acton Copper Mines. He says :

The most important mineral deposit which has yet come under my notice is that at the Acton Mines; and a deposit it is, for in all my experience in mining, in different countries, I have met with nothing near a comparison. The lode is exceedingly large, and the ores of rich quality; it is no rare thing to quarry rocks of mineral, tons in weight, worth 20 per cent. for copper, from it. The operations here have been on a limited scale, when compared with what might have and would have been done had it been the property of a spirited English company. I believe it is about three years since the first ore was sold from these mines. The parties connected with it had neither the means nor ability of carrying it out successfully, and therefore it has now fallen into the hands of a Mr. Davies. This deposit was first discovered within a few inches of the surface, and although over 100,000*l.* worth of mineral has been sold from from it, their deepest workings can still be prosecuted by daylight. The copper ore sold has averaged about 17 per cent., and there is no doubt but that it would make a produce of at least 20 per cent., if dressed with good machinery and management. The largest sale of ores from these mines for one month I believe to be about 600 tons, and from all appearance there would be no trouble in doubling that quantity, if worked extensively, without any probability of being speedily exhausted. This is without doubt a wonderful discovery, and one from which immense profits will be realised for a period impossible to state.

There are several other mining properties, which have been explored and found to contain large and productive copper lodes. I have examined some two or three of them, which have exceedingly good prospects, and are capable of yielding (though only just opened on at the back), from present appearances large quantities of mineral. At the Roxton, where the lode had been opened on at surface, I found it to be from 6 to 8 ft. wide, the whole of which, as broken, without dressing, would make a produce of 8½; and on being properly dressed I consider it worth as much as the Acton ores. Such a thing as this in Cornwall would soon be at a market value of £100,000, when at the same time it is here lying idle, for want of a little capital and proper persons to carry it out. Other properties, equally as good to all appearance, remain in the same neglected state, and the whole district, within 30 miles of the Acton Mines, appears to be full of mineral wealth, as in almost every instance where explorations have been carried on copper ore has been found to exist, and my opinion is that a district which will surpass it, when developed for copper ore, is not yet discovered. It appears to me as if this part of the colony has been, and still is, sadly neglected, both by gentlemen in this country and English capitalists. However, I am fully

satisfied that the war in the States has seriously made against the mining interest here, for had there been peace many more mines would undoubtedly have been working. The Acton Mines are visited almost daily by gentlemen from the principal cities and towns in Canada and the States, and several of the parties from New York and other state cities express their willingness and intention to work mines here at the termination of the war. I consider the present an unusual opportunity for the investment of English capital, and have often wondered the reason why there is not more doing in the matter. The climate is healthy, labour abundant and cheap, the ores can be sent to market on very reasonable terms, either to England or the United States, as the Grand Trunk Railway passes through the centre of the mining district, which would take the mineral to Montreal (a distance of about 50 miles) for exportation to England; or, in connection with other railways, to the United States smelting works. The country is well wooded, of which plenty can be obtained at a trifling expense for fuel and all other purposes. The advantages attending mining here are not be equalled in any other British colony, especially as regards the abundance and cheapness of labour, and transit of ores to market.

ON REFINING PETROLEUM.

The crude oils may at once be submitted to chemical treatment; but as a general rule, and especially when they are heavy and contain much tar, they should be first distilled. This distillation is made in a common iron still, protected from the action of the fire by fire-brick, which equallizes the heat, consequently, the expansion of the metal, and lessens the risk of fracture.

The charge of oil, prepared as above, may be run into the still and distilled, without the use of steam. But when it has been run off to four-fifths of the whole quantity, or when the part remaining in the still will be a thick pitch when cold, common steam should be gently let into the neck or breast of the still. The steam immediately produces an outward current through the condensing apparatus, and brings over all the remaining part of the oils, leaving a compact coke as the only residuum. Furthermore, it gradually diminishes the heat of the iron, and prevents it from breaking. When the steam is thus let in, the fire is to be removed from beneath the still.

Common steam, under moderate pressure, has been introduced into stills, both above the charge and into it throughout the entire distillation. In the latter instance, the steam soon becomes superheated after the lighter oils have been run off. Again, steam previously superheated is driven into the charge during the distillation, and for the distillation of the heavy oils and paraffin this mode has the preference; yet steam is advantageous, however applied. When it is superheated the condensing apraratus should be extensive.

In the first distillation of the crude oils, as they come from the retorts, and in subsequent ones, the oils may be slowly admitted into the stills after it has become sufficiently heated, and the oils begin to flow freely from the worm or condenser. By the adjustment of a cock, a stream of the crude product may be permitted to flow through an iron tube into the still while it is in operation. The tube should dip beneath the oil in the still, the inflow of oil into which must not exceed the out-flow from the condenser. A greater amount of heat will be required for this operation than for the common method, as much of it is taken up by the cold oil constantly flowing inward. By this mode, a still working 1000 gallons may be made to run double that quantity without interruption, and steam may be applied in any manner before described.

The first distillate of the crude oil should be separated into two parts, each of which requires somewhat different treatment. The first part is that which distils over from the commencement of the run until the oils in the receiver have a proof of 36° by hydrometer, or a specific gravity of 0·843.

These light hydro-carbons, and the eupion they contain, form the lamp-oil. The quantity produced will depend upon the quality of the coal, or whence they have been derived. This part of the distillate being pumped from the receiving tank, the remainder, or second part, is allowed to flow on till it assumes a greenish colour at the end of the worm pipe, when steam, if not previously employed, may be let into the still, and continued until the whole distillation is completed, the fire in the furnace being withdrawn. A quantity of coke will be found to remain, amounting to ten or fifteen per cent. of the whole charge. When steam is not employed in the residuum, the still must not be run down lower than a thick pitch. Coking in the still without steam is unsafe, and hazardous to the iron.

The first part is then to be placed in an iron cistern, and therein thoroughly agitated from one to two hours, with from four to ten per cent. of sulphuric acid, the object being to bring every particle of the impurities in contact with the acid. The quantity of acid to be used depends upon the character of the oils.

If too much acid is applied, the oils will be partially charred and discoloured; if too little, the impurities will not be oxidated, and the oils will change colour. After the agitation of the oils and acid is completed, the mixture must remain at rest from six to eight hours, when the acid, with the chief part of the impurities, will have settled at the bottom of the vessel. They are then to be drawn off, and the remaining oil to be washed with ten or twenty per cent. of water. The water removes a part of the remaining acid, and carries off the soluble impurities. After the water is withdrawn, the charge is to be agitated two hours with from five to ten per cent., by measure, of a solution of caustic potash, or soda, of specific gravity 1·400 —caustic soda is generally preferred. Like the acid, the strength and quality of the alkali must be varied according to the quality of the oils. After a repose of six hours, or more, the alkali is to be withdrawn from the oil, and further impurities washed out with water. When the water is withdrawn from it, it is to be run into a still for final rectification. During the whole of these operations, the oils and the several washes applied to them are to be kept at a temperature not lower than 90° F. This is done by means of steam coils fixed at the bottoms of the tanks in which the agitations are made. Finally, the oil is to be care-

fully distilled, with or without steam. A small quantity of the lightest product, or eupion, which comes first from the condensing worm, is usually discoloured, and may therofore be transferred to the succeeding charge.

The last distillation should be made slowly and with care, avoiding all fluctuations produced by an unsteady heat. If desired, the eupion may be taken off at the commencement of the distillation. It should be at proof 60°, or specific gravity, 0·733, or it may be allowed to run in with the lamp-oil. When the distillate has reached proof 40°, or specific gravity 0·819, the remainder is to be transferred to the next charge, or the heavy oil, as being too dense for illuminating purposes. The mixed oils intended for lamps have their disagreeable odour chiefly removed by allowing them to remain in flat open cisterns over weak solutions of the alkalies during a period of some days. Exposure to light also improves their colour. The alkalies employed in the foregoing treatment may be restored and used in subsequent purifications. The oils of the second or heavy part of the first distillate are purified by the same means as described for the lighter oils, except that they require the application of more acid and stronger alkalies. All the oils distilled from them at proof 40° are added to the lamp-oils. At the close of each distillation, and as the oils acquire greater density, the colour grows dark and changeable; finally, they are partially charred, and especially when they have been distilled without steam. These dark-coloured oils may always be renovated by the use of acids and alkalies, the permanganates of potash and soda, and, finally, by distillation. The colour of the lamp-oils should not exceed a tinge of greenish yellow, when viewed in a clear glass flask six inches in diameter. If by accident, carelessness, or negligence, the oils treated by the fore-going method should be impure, they must be submitted to washing and re-distillation.—*Philadelphia Coal Oil Circular.*

PURIFICATION OF WATER FOR PHOTOGRAPHIC AND OTHER PURPOSES.

An interesting and valuable pamphlet has recently been published by Mr. Condy, in which the removing from water of a variety of impurities is described. For this purpose the well-known action of alkaline permanganates is made available.

"By the peculiar chemical properties of the permanganic acid it is capable, when employed in appropriate combination, of not only destroying every trace of organic matter in a water, but it also removes many of the mineral constituents which are sometimes almost as objectionable. An experiment of Mr. Condy's shows this in a striking manner. He made a saturated solution of oxide of lead, by shaking common whitelead in distilled water, and filtering; this, on being tested with hydrosulphuric acid, gave a black precipitate. Four ounces of this liquid were then taken, and to it were added two drops of a weak solution of permanganate of lime. Upon standing for half an hour, the pink colour had disappeared; and when filtered off from the precipitated peroxide of lead and binoxide of manganese, there was only a brown tint communicated to it on testing with hydrosulphuric acid. Another similar experiment was tried, in which a little more permanganate of lime was added, and the liquid allowed to stand for some hours, when, upon filtering again, not a trace of lead was found in solution. Lead is a most difficult impurity to remove from water, whilst it is the most poisonous of ordinary metallic contaminations, but is thus easily removed, as well as all metals capable of assuming the form of peroxides. Water containing iron in solution can also be purified in the same manner, so as to render it fit for use in dyeing and other industrial purposes."

The presence of organic impurities is, however, most detrimental to the photographer; and Condy's fluid is preëminently valuable in removing these. On this point the author says, "Filtration through charcoal or bone-black has no doubt considerable effect in absorbing certain gases, which are products of the decomposition of organic matter; but it acts only very partially on such matter when not in a decomposing state. Hence water which has been more or less deodorized by charcoal will often be found, on being allowed to stand to become again offensive from the further decomposition of organic matter, which the charcoal had been inadequate to remove. The presence of such organic impurities in water which has been treated with charcoal can always be readily detected by permanganates. Nothing proves so distinctly the superiority of those substances for purifying water as the certain and delicate way in which they discover the imperfections of all other methods of purification, whereas no substance that I am acquainted with is capable of revealing the presence of organic matter after their use as purifiers. The permanganates, then, not only afford a ready and efficacious means of doing what charcoal is supposed, in a tedious and imperfect manner, to perform, but likewise of producing changes similar to those effected by most of the other modes of purification which are usually recommended or occasionally practised. Thus they do all that alum, caustic alkalies, alkaline carbonates, and caustic lime are capable of accomplishing; while they even surpass ebullition and distillation in their power of removing organic matter, at the same time that, by the formation and precipitation of oxide of manganese which take place at all points of the water during their contact with substances of an organic origin, they have the effect of mechanically drawing down impurities held in suspension. Add to this, that water purified by the permanganates is, in most instances, pure enough for every ordinary purpose, and so charged with oxygen as to be highly agreeable to the palate, and beneficial to digestion. When absolutely pure water is required for some special scientific object, it can be readily procured with one distillation, by the use of an alkaline permanganate."

The advantages of this system, so far as simplicity and efficiency are concerned, cannot very well be over-estimated, whilst its economy is beyond impeachment. "The quantity of permanganate necessary to purify 10,000 gallons of water would be contained in one gallon of Condy's Fluid, the price of which is only 10*s.*; at this rate 200 gallons, or one ton, of water could be purified at an outlay of 2½*d.*" A series of interesting experiments and instructions as to the method of proceeding are given in the pamphlet, one or two of which we shall quote. In order to test water for organic impurities, proceed as follows:—

"Take any number of tumblers; fill up one with distilled water, another with ordinary drinking-water from a pump, rain-water-butt, or other supply, and the rest with various samples of water more or less contaminated with organic impurities such as sewage water. Add to each of them, drop by drop, Condy's Fluid (crimson) till the contents begin to assume a decidedly pink hue. This effect will be produced, in the case of the distilled water, if pure, by a single drop; more will be required by the drinking-water, which, after standing a little while, will show some signs of muddiness; and a still larger portion by the other samples, in which a brown precipitate will soon form. The quantity of fluid required and the amount of muddiness produced in each will be the measure of the relative impurities of the several waters."

Here is a method by which the photographer can readily purify sufficient water to last for a few weeks' use:—

"Pour into a hogshead of offensive drinking-water one wineglassful of Condy's Fluid, and mix with a stick or lath. Generally this quantity will render it as sweet as fresh water: should it require more, add half a wineglassful. So long as organic matter remains—which is known by the pink colour of the fluid gradually vanishing—add the fluid. If a trace too much has been used, continue stirring, or immerse a stick or lath, and the colour will disappear. Let it stand, and any suspended matter present will subside or filter."

Where water is required absolutely pure, the simplest mode of procuring it is to mix with permanganate of potash and distil; the result will be water of unusual purity.—*Photographic Journal.*

Miscellaneous.

Electric Lamp for Miners.

An electric lamp for miners has been submitted to the French Academy of Sciences by MM. Dumas and Benoit. They do not claim the merit of the first idea, but state that hitherto they have met with no apparatus perfectly suitable for the purpose, although experiments relating to it have been made with good results by MM. Du Moncel and Despretz. The new apparatus consists of three essential parts—a small voltaic battery, a Ruhmkorff's induction coil, &c., and one of Geissler's illuminating tubes. The whole are so arranged as to produce a light sufficient for the miner to work in an atmosphere where other lamps would be extinguished. The light produced is cold, or rather does not heat the tube in which it is produced, and it is inaccesssible to gas. The entire apparatus is perfectly isolated; it is quite as solid as the lamps now in use; no injurious or disagreeable emanation proceeds from it; and it can be instantaneously lit or extinguished at pleasure. It will act for many consecutive hours without the light diminishing, and without any particular attention being required. The workman will have only at long intervals to agitate the charcoal with a wire. The greatest difficulty to contend with was the association of a battery of such an intensity with a coil constructed in such a manner that the bulk and weight of the apparatus should be as limited as possible, and with a light of very great regularity to endure for at least 12 hours. MM. Dumas and Benoit state that they are certain of being able to reduce the dimensions of their apparatus still further, although it is now already sufficiently portable for its purpose.

Mr. Glaisher's Balloon Ascents.

The attention of the scientific world has lately been called to the balloon ascents of M. Glaisher, and several interesting facts have been brought to light which deserve to be recorded. It appears that when the voyagers reached the clouds they found themselves surrounded with a dense mass of moisture, about two thousand feet in thickness, which, being passed through, a beautiful clear blue sky presented itself, with the mass of clouds floating below, After this, being above a mile and three-quarters from land, they could not perceive any clouds, but the air seemed to possess such expansive power that the balloon shot up very rapidly, so that Mr. Glaisher failed to obtain a photograph of the scene below. Several pigeons were thrown out, but dropped as heavy as a stone. Blindness began to be felt at five miles' altitude, and M. Glaisher's last entry of the thermometer was *minus* five, or thirty-seven below the freezing point. Subsequently he saw but was unable to register, the barometer at 10°, after which he became almost unconscious; and when they had attained an altitude of six miles Mr. Coxwell's hands turned black and he began to faint. M. Glaisher then recovered sufficiently to hear his companion say, "I have lost the use of my hands: give me some brandy to bathe them." The temperature was then below zero; and the water in the vessel supplying the wet-bulb thermometer was one solid mass of ice. At this point, the æronauts seemed to incur great risk; for while M. Glaisher could not move, Mr. Coxwell was seized with intense cold, and everything seemed now to depend upon the latter gentleman, whose self possession and ease seemed quite wonderful. M. Glaisher says, "it was quite characteristic of Mr. Coxwell," For he had never seen him without a ready means of meeting every difficulty when it has arisen; and so it proved, for just at this juncture, as the hoar frost surrounded his neck, and his hands were helpless, he seized the line between his teeth and pulled the valve open until the balloon took a turn downwards.

The height attained was certainly unprecedented, and from the description which has appeared in the daily papers, written by M. Glaisher himself it seems to have been attended with no ordinary danger. M. Glaisher wisely concludes his interesting scientific notations by observing, that "it "would seem from this ascent that five miles from "the earth is very nearly the limit of human existence. It is possible, as the effect of each higher ascent upon myself has been different, that on "another occasion I might be able to go higher, "and it is possible that some persons may be able "to exist with less air and bear a greater degree "of cold; but still I think that prudence would "say to all, whenever the barometer reading falls "as low as 11 inches, open the valve at once; the "increased information to be obtained is not commensurate with the increased risk. (*See Mr. Glaisher's paper on another page of this number.*